DOE/ID-10955
Revision 0
May 2002

U.S. Department of Energy
Idaho Operations Office

ICDF Complex Groundwater Monitoring Plan

INEEL
Home of Science and Engineering Solutions
Idaho National Engineering and Environmental Laboratory

DOE/ID-10955
Revision 0

ICDF Complex Groundwater Monitoring Plan

May 2002

Prepared for the
U.S. Department of Energy
Idaho Operations Office

ABSTRACT

This groundwater monitoring plan, along with the *Quality Assurance Project Plan for Waste Area Group 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2000a), constitutes the sampling and analysis plan for groundwater and perched water monitoring at the INEEL CERCLA Disposal Facility (ICDF) Complex. A detection monitoring system is being installed in the Snake River Plain Aquifer (SRPA) to comply with substantive requirements of 40 CFR 264, Subpart F, of the Resource Conservation and Recovery Act (RCRA). Water samples will be collected and analyzed from perched water and the SRPA to monitor for releases from the ICDF landfill and evaporation pond. Five new downgradient aquifer monitoring wells will be constructed, and one existing upgradient well will be used for the SRPA detection monitoring. Six new perched water wells, with a maximum of three completions in each borehole, will also be installed. To establish background contaminant concentrations, four samples will be collected from the SRPA monitoring wells prior to startup of the ICDF Complex operations in May 2003. Due to the limited sampling volume expected in the perched water, baseline data may not be complete for the perched water wells. After startup, samples from the detection monitoring network will be collected semiannually for indicator parameters. Once every 2-1/2 years, samples will be analyzed from perched water and SRPA monitoring wells for a more comprehensive list of analytes.

Underneath the ICDF Complex, the SRPA is contaminated from an upgradient injection well that is now closed. Percolation ponds that are adjacent to the ICDF Complex and were formerly used to dispose of hazardous waste also contaminated the perched water beneath the ICDF Complex. These ponds are scheduled for removal from service in December 2003. Detection monitoring wells in the perched water are subsequently expected to dry up, because the percolation ponds are the primary source of water. Once perched water monitoring wells go dry, they will not be deepened or replaced.

Although not part of the RCRA Subpart F detection monitoring, this groundwater monitoring plan also includes collection of samples from the tertiary leak detection system and the leachate collection system. These data, along with water level data and data from existing wells, will be used as lines of evidence to determine whether a release occurs from the ICDF landfill or evaporation ponds. Because of the pre-existing contamination and because perched water concentrations may increase as perched water levels decline, analysis of the detection monitoring data will be complicated. A data evaluation plan will be prepared and submitted once baseline data have been collected and analyzed.

CONTENTS

FIGURES

TABLES

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cfs	cubic feet per second
CM	construction manager
COC	contaminant of concern
DQO	data quality objective
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOT	Department of Transportation
EPA	Environmental Protection Agency
ERIS	Environmental Restoration Information System
ES&H	Environmental, Safety, and Health
FFA/CO	Federal Facility Agreement and Consent Order
FTL	field team leader
GDE	guide (document)
HASP	health and safety plan
HDR	Hydrogeologic Data Repository
HSO	health and safety officer
ICDF	INEEL CERCLA Disposal Facility
ID	identification
IDEQ	Idaho Department of Environmental Quality
IEDMS	Integrated Environmental Data Management System
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
K_d	distribution coefficient [L^3/m]

L&V	limitations and validation
MCL	maximum contaminant level
meq/L	millequivalents per liter
O&M	operations and maintenance
OU	operable unit
QA	quality assurance
QC	quality control
QA/QC	quality assurance/quality control
PCB	polychlorinated biphenyl
PES	performance evaluation sample
PPE	personal protective equipment
PW	perched wells
RAO	remedial action objective
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SAP	sampling and analysis plan
SDG	sample delivery group
SLDRS	secondary leachate detection and removal system
SMO	Sample Management Office
SNF	spent nuclear fuel
SRPA	Snake River Plain Aquifer
SSSTF	Storage, Staging, Sizing, and Treatment Facility
STR	subcontract technical representative
SVOCs	semivolatile organic compounds

SWW	service waste water
TEGD	Technical Enforcement Guidance Document (RCRA Groundwater Monitoring)
TSCA	Toxic Substances Control Act
USGS	U.S. Geological Survey
VOCs	volatile organic compounds
WAC	Waste Acceptance Criteria
WAG	waste area group

ICDF Complex Groundwater Monitoring Plan

1. INTRODUCTION

1.1 Project Background

The U.S. Department of Energy Idaho Operations Office (DOE-ID), the U.S. Environmental Protection Agency (EPA), and the Idaho Department of Environmental Quality (IDEQ) (collectively referred to as the Agencies) authorized a remedial design/remedial action for the Idaho Nuclear Technology and Engineering Center (INTEC) in accordance with the Waste Area Group (WAG) 3, Operable Unit (OU) 3-13 Record of Decision (ROD) (DOE-ID 1999). The ROD requires Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remediation wastes generated at the Idaho National Engineering and Environmental Laboratory (INEEL) to be removed and disposed of on-Site in the INEEL CERCLA Disposal Facility (ICDF) Complex. Other INEEL CERCLA wastes can be managed and disposed of at the ICDF Complex in accordance with other RODs. The ICDF Complex, located south of INTEC (Figures 1-1 and 1-2), is an on-Site, engineered facility meeting the substantive requirements of U.S. Department of Energy (DOE) Order 435.1, Resource Conservation and Recovery Act (RCRA) Subtitle C, the Idaho Hazardous Waste Management Act, the Toxic Substances Control Act (TSCA), and polychlorinated biphenyl (PCB) landfill design and construction requirements. The ICDF Complex includes the necessary subsystems and support facilities to provide a complete waste management and disposal system.

The major components of the ICDF Complex are the landfill disposal cells, two evaporation ponds, and the Staging, Storage, Sizing, and Treatment Facility (SSSTF). The disposal cells, including a buffer zone, will cover approximately 40 acres, with a disposal capacity of about 510,000 yd^3 (389,900 m^3). The SSSTF will be designed to provide centralized receiving, inspection, and treatment necessary to stage, store, and treat incoming waste from various INEEL CERCLA remediation sites prior to disposal in the ICDF landfill or in evaporation ponds or shipment off-Site. All ICDF Complex activities will take place within the WAG 3 area of contamination to allow flexibility in managing the consolidation and remediation of wastes without triggering land disposal restrictions and other RCRA requirements, in accordance with the OU 3-13 ROD. Only low-level, hazardous, mixed, and limited quantities of TSCA wastes will be treated and/or disposed of at the ICDF Complex. Most of the waste will be contaminated soil, but debris and investigation-derived waste will also be included in the waste inventory. ICDF landfill leachate, decontamination water, and water from WAG 3 well drilling, purging, sampling, and well development and maintenance activities will be disposed of in the ICDF evaporation pond.

Only INEEL on-Site CERCLA wastes meeting the appropriate Agency-approved Waste Acceptance Criteria (WAC) will be accepted at the ICDF Complex. Treatability testing can be used to determine if the waste can be treated to meet the WAC. An important objective of the WAC will be to ensure that hazardous substances disposed of in the ICDF landfill and evaporation ponds will not exceed groundwater quality standards in the underlying Snake River Plain Aquifer (SRPA). The WAC will include restrictions on contaminant concentrations based on groundwater modeling results, with the goal of preventing potential future exceedance of maximum contaminant levels (MCLs) in the SRPA from ICDF Complex operations and disposal.

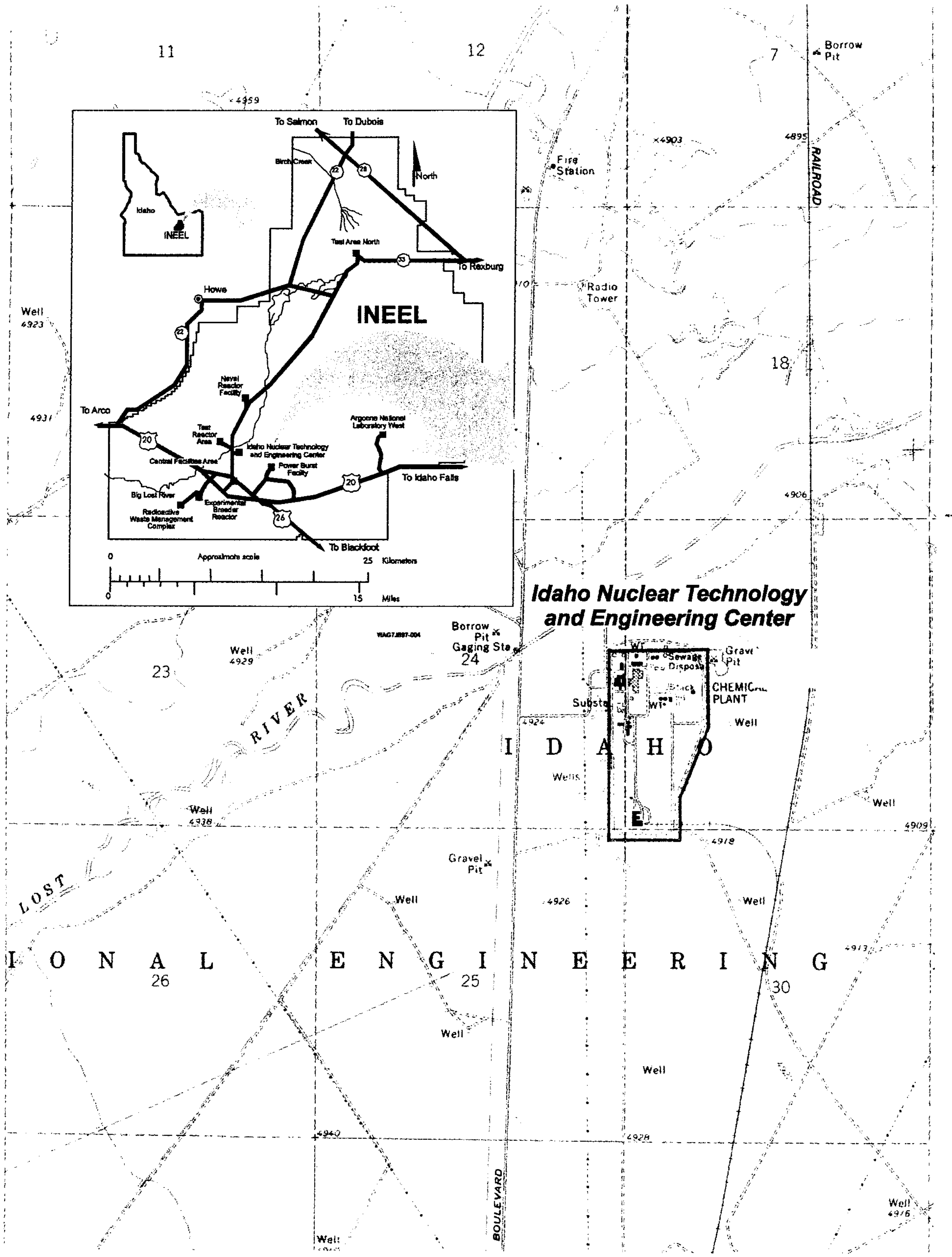

Figure 1-1. Location of INTEC within the INEEL.

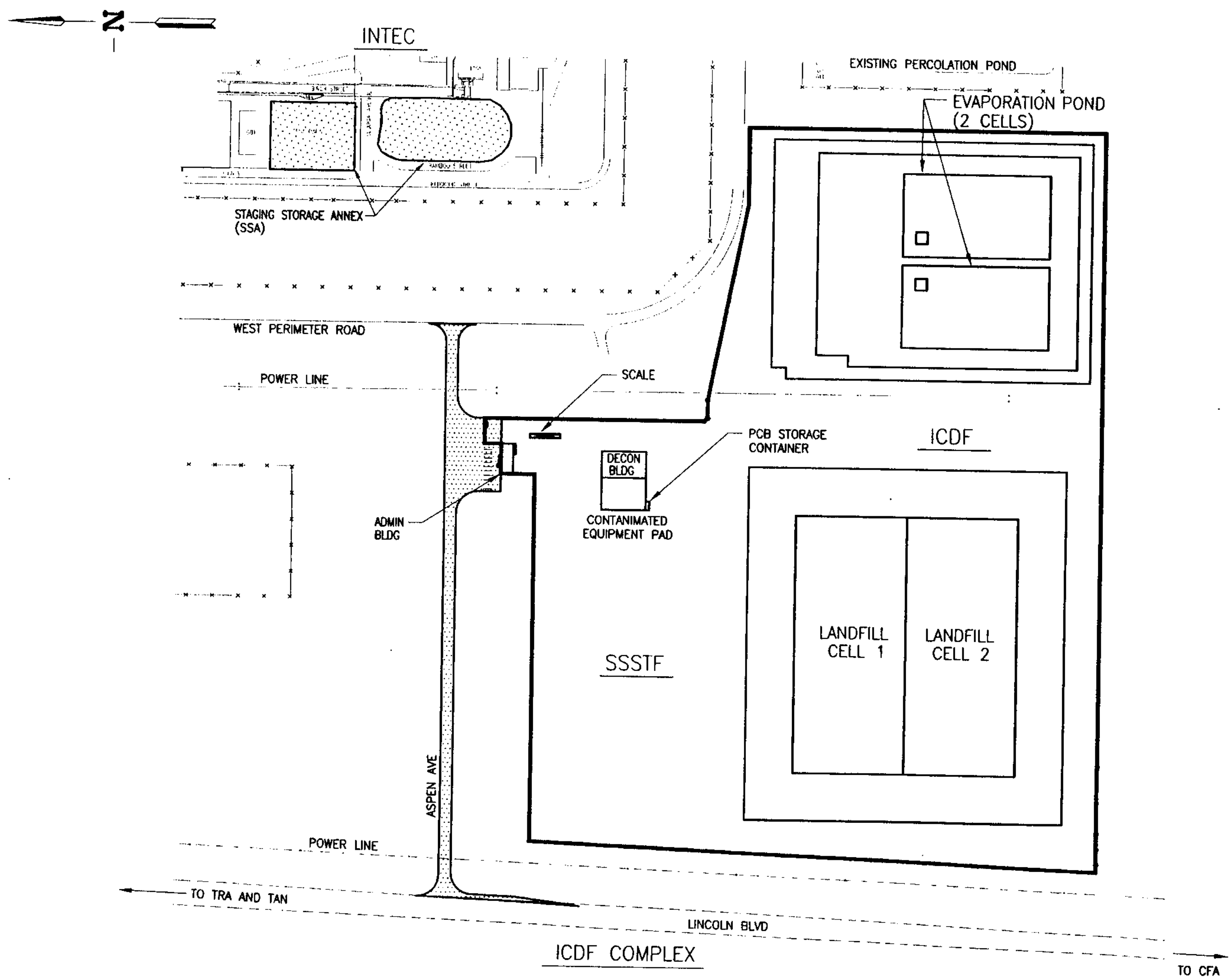

Figure 1-2. ICDF Complex layout.

1.2 Regulatory Requirements

The OU 3-13 ROD (DOE-ID 1999) is very specific on which sections of 40 CFR 264, Subpart F, are applicable or relevant and appropriate requirements (ARARs) for the ICDF Complex. The ARARs are listed in Table 1-1 and discussed individually to clarify when and how they apply to the groundwater monitoring system. Note that only the substantive requirements of the ARARs need to be met.

Table 1-1. ICDF Complex groundwater monitoring ARARs.

ARAR	Description
IDAPA 16.01.05.008[a] (40 CFR 264.92)	Groundwater protection standard
IDAPA 16.01.05.008 (40 CFR 264.93)	Hazardous constituents
IDAPA 16.01.05.008 (40 CFR 264.95)	Point of compliance
IDAPA 16.01.05.008 (40 CFR 264.97)	General groundwater monitoring requirements
IDAPA 16.01.05.008 (40 CFR 264.98)	Detection monitoring program

a. IDAPA 16... is now IDAPA 58....

The groundwater protection standard is found in 40 CFR 264. 92 and requires that

> ...hazardous constituents under §264.93 detected in the groundwater from a regulated unit do not exceed the concentration limits under §264.94 in the uppermost aquifer underlying the waste management area beyond the point of compliance.

However, §264.94 is not an ARAR, and the standard which was set in the OU 3-13 ROD is to prevent the release of leachate to underlying groundwater which would result in exceeding MCLs, a cumulative carcinogenic risk of 1×10^{-4}, or a Hazard Index of 1 in the SRPA. In 40 CFR 264.97, the major components required for the construction of the monitoring system are outlined, and this groundwater monitoring plan outlines the ICDF Complex compliance with those requirements. Since the ICDF Complex is a new unit and a leak cannot have occurred from a unit under construction, the ARAR for the monitoring system is 40 CFR 264.98, "Detection Monitoring." Should a leak from the unit occur, then compliance monitoring will be implemented as outlined later in the plan. The main components of detection monitoring are outlined in Section 1.2.1, and compliance monitoring is discussed in Section 1.2.2.

1.2.1 General Monitoring Requirements

The applicable general monitoring requirements are found in 40 CFR 264.97. As allowed under 40 CFR 264.97 (b), the groundwater monitoring system being installed for the ICDF Complex will be designed for the landfill and the evaporation pond as a single regulated unit. Because the landfill and evaporation ponds have leak detection systems and the monitoring system will enable detection and measurement at the point of compliance in the uppermost aquifer, a single monitoring system is adequate. The point of compliance for this facility is the area described by an imaginary line circumscribing the ICDF landfill and evaporation ponds (40 CFR 264.95), and 40 CFR 264.97 (a) states, "The groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths to yield ground-water samples from the uppermost aquifer." The ICDF Complex will include one upgradient and five downgradient wells completed in the upper portion of the SRPA (this will be discussed in Section 3). The downgradient wells will be newly installed wells that meet the substantive requirements of the *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document*

(TEGD) (EPA 1986). The selected upgradient well is U.S. Geological Survey (USGS) -123, which already exists. Six new perched water monitoring wells will be installed with a maximum of three completions in each borehole.

The groundwater monitoring program for sampling and analytical methods is discussed in Sections 3 and 4 of this plan. The monitoring program will include a determination of water levels each time groundwater is sampled. The monitoring program will include a sequence of four baseline samples taken from the SRPA prior to startup. For the SRPA, baseline water quality will be established using water quality from upgradient wells and downgradient wells prior to landfill operation. The background water quality will be different from uncontaminated concentrations upgradient of INEEL facilities. Because the existing groundwater is contaminated, the baseline water quality will be considered background for the purposes of the substantive RCRA requirements. Up to four samples will be collected from perched water, depending on available volumes.

This sampling plan is based on historical information and evaluations of the effective porosity, hydraulic conductivity, gradient, and fate and transport of the potential contaminants. After operations start, sampling will occur semiannually for indicator parameters and once every 2-1/2 years for a larger list of analytes.

The method for determining a leak from the unit will fulfill all the requirements outlined in 40 CFR 264.97(i). This methodology will be discussed in the ICDF Complex remedial action work plan (RAWP), which will be submitted to the Agencies. All groundwater data will be maintained in the facility operating record for the period outlined in Section XX of the Federal Facility Agreement and Consent Order (FFA/CO) (DOE-ID 1991). These data will be maintained in a format that allows for determination of a significant difference between upgradient and downgradient water quality.

1.2.2 Detection Monitoring Program

Until such time as statistically significant evidence demonstrates a release from the ICDF Complex, detection monitoring will be conducted at the ICDF Complex as allowed by 40 CFR 264.98. The indicator parameters that are relevant for, and allowed under, 40 CFR 264.98 (a) are listed in Sections 3 and 4 of this plan. In developing these indicator parameters, the following factors were considered:

- The types, quantities, and concentrations of constituents managed within the ICDF Complex
- The mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the waste management unit
- The detectability of indicator parameters, waste constituents, and reaction products
- The concentrations or values and coefficients of variations of proposed monitoring parameters or concentrations in the background groundwater.

The downgradient wells, which are discussed further in Section 4.1.1, will be installed just beyond the downgradient edge of the southern ICDF landfill cell (#2) and the evaporation ponds.

1.2.3 Statistically Significant Evidence of Contamination

If evidence of increased contamination in the perched water or SRPA is determined based upon evaluation of detection monitoring data, then the Agencies will be notified in accordance with Section XIX of the FFA/CO. The notification will indicate which chemical parameters or hazardous waste detections are statistically significant.

- If a statistically significant exceedance is detected, all ICDF monitoring wells in the SRPA will be immediately sampled for Appendix IX constituents.

- If the results indicate any Appendix IX compounds are above baseline concentrations, the wells will be re-sampled. If those sample results confirm the first sampling and the source is not from another source [264.98 (g)(6)], then 40 CFR 264.99 requirements are triggered. If the sampling does not confirm the first sampling, a third sample will be taken. If the third sample does not indicate a leak, the first sample will be considered an error.

If 40 CFR 264.99 requirements are triggered, a compliance monitoring program will be initiated that meets the substantive requirements. This will include all the information required under 40 CFR 264.98(g)(4). A corrective action plan will be sent to the Agencies to meet the requirements of 40 CFR 264.98(g)(5).

Because of the pre-existing contamination underlying the ICDF Complex, evaluation of the data will be complicated. Data from the leachate collection system, the tertiary leak detection system, water levels, and existing wells will be used as lines of evidence to determine whether a release occurs from the ICDF Complex. Because of the pre-existing contamination and because perched water concentrations may increase as perched water levels decline, analysis of the detection monitoring data will be complicated. A data evaluation plan will be submitted once baseline data have been collected and analyzed.

1.3 Objectives and Scope

The objectives of this groundwater monitoring plan are to provide for well drilling, installation, and maintenance and sample collection, analysis, and interpretation required to meet ARARs, remedial action objectives (RAOs), and remediation goals established in the OU 3-13 ROD (DOE-ID 1999) for groundwater monitoring at the ICDF Complex. The OU 3-13 ROD RAOs for groundwater require DOE to, "maintain caps placed over...the closed ICDF-complex, to prevent the release of leachate to underlying groundwater which would result in exceeding a cumulative carcinogenic risk of 1×10^{-4}, a total HI [hazard index] of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs) in the SRPA." The basic objective of the groundwater monitoring is to determine if a release of contaminants has occurred from the ICDF landfill cells or evaporation ponds and whether it would adversely affect the water quality in the SRPA.

The scope of this groundwater monitoring plan is for the installation of new wells and long-term collection and analysis of water samples from the SRPA and perched water beneath the ICDF Complex. Samples will be collected from a specially constructed tertiary barrier immediately beneath the primary and secondary landfill liners and leak detection systems. In addition, samples will be collected from the landfill's leachate collection system to allow for "fingerprinting" of the leachate and comparison of water samples collected from the tertiary barrier sump to actual landfill leachate. Leachate sampling will also allow for periodic evaluation and updating of the list of indicator analytes. SRPA groundwater samples will be collected from a detection monitoring network upgradient and downgradient of the ICDF Complex. Sampling of the SRPA will use one existing monitoring well upgradient of the ICDF Complex and five new monitoring wells to be constructed downgradient of the landfill. Four baseline SRPA samples will be collected prior to startup of the ICDF Complex operations. Six new perched water monitoring wells will be installed, with a maximum of three completions in each borehole. Indicator parameters will be monitored on a semiannual basis, and a larger list of analytes will be monitored every 2-1/2 years throughout operations and closure of the ICDF Complex in 2048. Following closure of the ICDF Complex landfill and evaporation ponds, monitoring will continue in order to meet the RAOs established in the OU 3-13 ROD.

2. SITE DESCRIPTION AND BACKGROUND

Both a remedial investigation/feasibility study (RI/FS) (DOE-ID 1997a, 1997b, and 1998) and a ROD (DOE-ID 1999) have been completed for the ICDF Complex site at INTEC. With a completed RI/FS and ROD, significant site characterization work (including site geology, hydrology, and nature and extent of contamination) has been conducted for the subsurface at the location of the new ICDF Complex. In addition, monitoring of the unsaturated zone and SRPA is underway at INTEC as part of the WAG 3 Group 4 Perched Water and Group 5 SRPA remedial actions (DOE-ID 2000b and 2000c).

2.1 Site Background

The INEEL is a government-owned facility managed by the DOE. The eastern boundary of the INEEL is located 32 mi west of Idaho Falls, Idaho. The INEEL Site occupies approximately 890 mi^2 of the northwestern portion of the eastern Snake River Plain in southeast Idaho. The INTEC facility covers an area of approximately 0.15 mi^2, and is located approximately 45 mi from Idaho Falls, in the south-central area of the INEEL, as shown in Figure 1-1. The ICDF Complex will be constructed adjacent to the southwest corner of the INTEC facility (Figure 1-2).

INTEC has been in operation since 1952. Its original mission was to reprocess uranium from defense-related projects and to research and store spent nuclear fuel (SNF). The DOE phased out the reprocessing operations in 1992 and redirected the INTEC mission to (1) receipt and temporary storage of SNF and other radioactive wastes for future disposition, (2) management of current and past wastes, and (3) performance of remedial actions.

The liquid waste generated from past reprocessing of SNF was stored in an underground tank farm. The INTEC tank farm consists of eleven 300,000-gal tanks, four 30,000-gal tanks, and associated equipment for the monitoring and control of waste transfers and tank parameters. One of the 300,000-gal tanks is empty and serves as a spare tank in the event of an emergency. The majority of wastes that were stored in the tank farm were raffinates generated during the first-, second-, and third-cycle fuel extraction processes.

Numerous CERCLA sites are located in the area of the tank farm and adjacent to the process equipment waste evaporator. Contaminants found in the interstitial soils of the tank farm are the result of accidental releases and leaks from process piping, valve boxes, and sumps and are also the result of cross-contamination from operations and maintenance excavations. No evidence has been found to indicate that the waste tanks themselves have leaked. The contaminated soils at the tank farm make up about 95% of the known contaminant inventory at INTEC. The final comprehensive RI/FS for OU 3-13 (DOE-ID 1997a, 1997b, and 1998) contains a discussion of the nature and extent of contamination.

The contamination in the SRPA originated primarily from the former injection well (shown as CPP-3 on Figure 2-1). However, contaminated soils and perched water were predicted from modeling during the OU 3-13 remedial investigation/baseline risk assessment to contribute to future SRPA contamination if sites were not remediated (DOE-ID 1997a). The iodine-129 (I-129), strontium-90 (Sr-90), and plutonium isotopes were determined to be the only contaminants that could pose an unacceptable risk to a hypothetical future resident beyond the year 2095. The primary I-129 source was the former injection well. The primary Sr-90 sources were the former injection well and the tank farm soils. The primary source of plutonium isotopes is the tank farm. The major human health threat posed by contaminated SRPA groundwater is exposure to radionuclides via ingestion by future groundwater users.

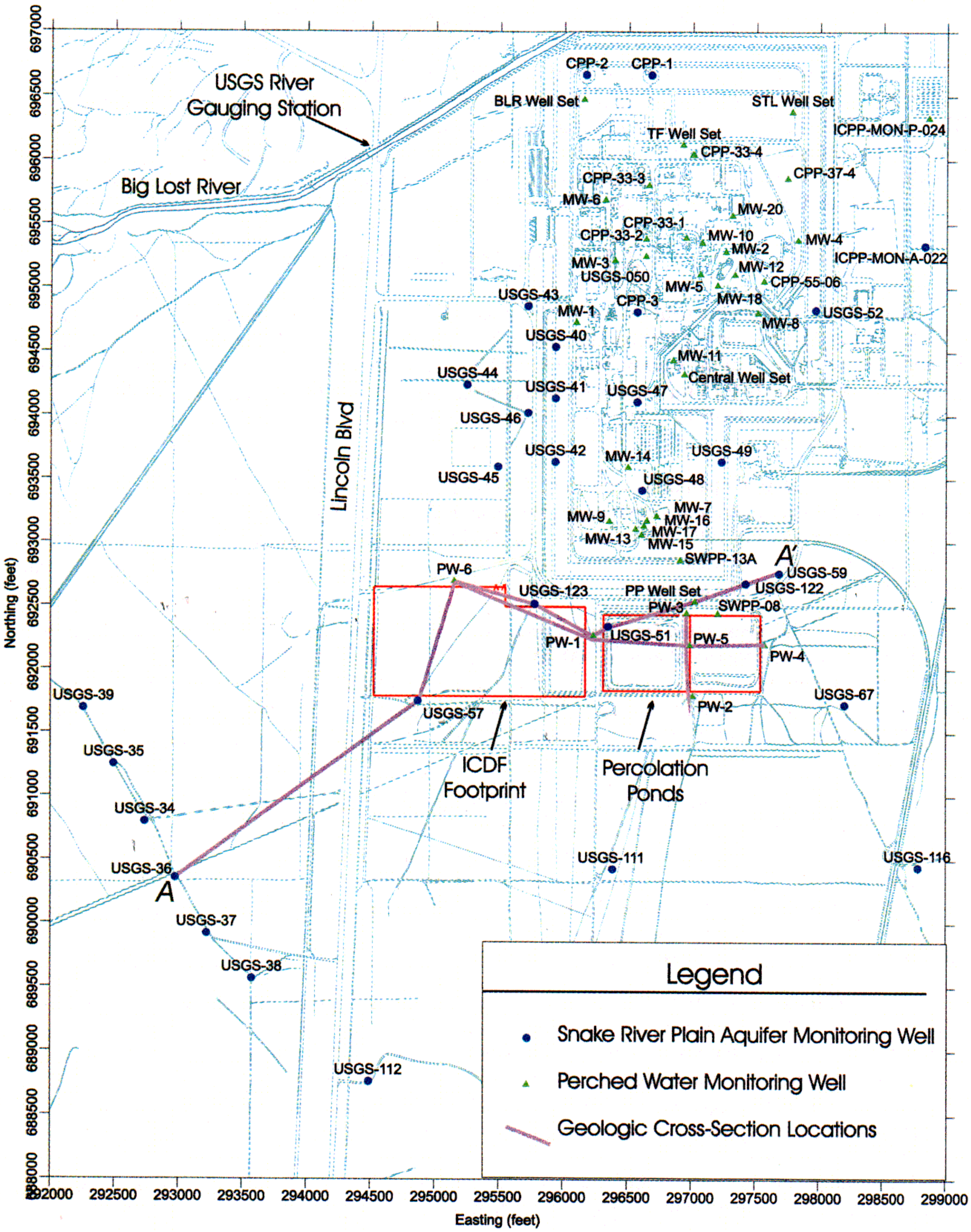

Figure 2-1. Locations of geologic cross sections and existing wells.

2.2 Site Conceptual Model

2.2.1 Subsurface Geology

The geology beneath the ICDF Complex is summarized in this section. For a more complete description, see other DOE-ID documents (1997a, 1997b, and 1998). The subsurface geology has been characterized through the drilling of numerous SRPA and perched water wells and coreholes located in the vicinity of the ICDF Complex and INTEC. Information on the subsurface has been gathered from logs (lithologic, geophysical, and video) as well as tests (geotechnical and hydrologic). The locations of wells closest to the ICDF Complex are shown on Figure 2-1. An east-west geologic cross section through the ICDF Complex (A-A' on Figure 2-1) is shown on Figure 2-2 and is based on an analysis of lithologic logs and geophysical logs (such as neutron, caliper, and natural gamma) and an inspection of the cores.

The subsurface beneath the ICDF Complex, as shown on Figure 2-2, is characterized by approximately 30 to 55 ft of alluvial materials underlain by a series of basalt flows and discontinuous sedimentary interbeds. The surface alluvium at the ICDF Complex has been mapped as a flood delta or fan related to late Pleistocene cataclysmic flooding, most likely from the Pinedale Glaciation (Rathburn 1991). The Pinedale Glaciation occurred between 12,000 and 35,000 years ago. An intermittent layer of fine sand, silt, and clay known as "old alluvium" in the literature (designation SM to CL) ranges in thickness from 0 to 13 ft and occurs at the top of basalt. The thickness correlates to low spots and depressions and tends to increase to the south and west of the ICDF Complex. It is less prevalent in the northwest area. Sand lenses were periodically found within this layer. The sediments overlie vesicular dark gray, olivine basalt bedrock that may be weathered and fractured in the first several feet near the interface (DOE-ID 2000d).

As can be seen in Figure 2-2, two very distinctive massive basalt flows can be used as marker beds and traced between most boreholes underneath the ICDF Complex. The depth at which these distinctive flows occur varies between boreholes. The CD basalt flow occurs at a depth between approximately 135 and 175 ft, and the DE5 basalt occurs at a depth between approximately 320 and 395 ft in USGS-57. The CD basalt flow is characterized by a higher-than-average natural-gamma count. Above the CD basalt flow is a fairly continuous series of thin interbeds interspersed with thin basalt flows. This is the most continuous interbed underlying the ICDF Complex and is the location of perched water that forms intermittently in response to wastewater discharges to the percolation ponds. As can be seen on Figure 2-2, the other interbeds are discontinuous, are less massive, and cannot be traced horizontally between boreholes. The DE5 basalt is among the thickest and most massive of the basalt flows found in the subsurface underlying the ICDF Complex and has a typical thickness of nearly 100 ft.

Well USGS-51 is completed in the SRPA and is just east of the ICDF Complex, between the ICDF Complex and the west percolation pond. In this well, there are at least six sedimentary interbeds and 13 basalt flow groups. Narrow interbeds ranging from 4 to 15 ft thick are interspersed with basalt flow groups ranging from 8 to 96 ft thick (Anderson 1991). For a more detailed description of the methods used to characterize the lithology underlying the ICDF Complex, see Appendix A.

2.2.2 Hydrogeology

2.2.2.1 Surface Water Sources. The Big Lost River flows through Mackay Reservoir, past Arco, Idaho, and then turns northeast to its terminus on the INEEL in playas known as the Lost River Sinks. Water from the Big Lost River is diverted for irrigation and can be diverted into the INEEL spreading to areas upstream of INTEC. The Big Lost River is ephemeral on the INEEL. When it is flowing, it passes by the northwest corner of INTEC and is over 3,000 ft from the closest corner of the ICDF Complex.

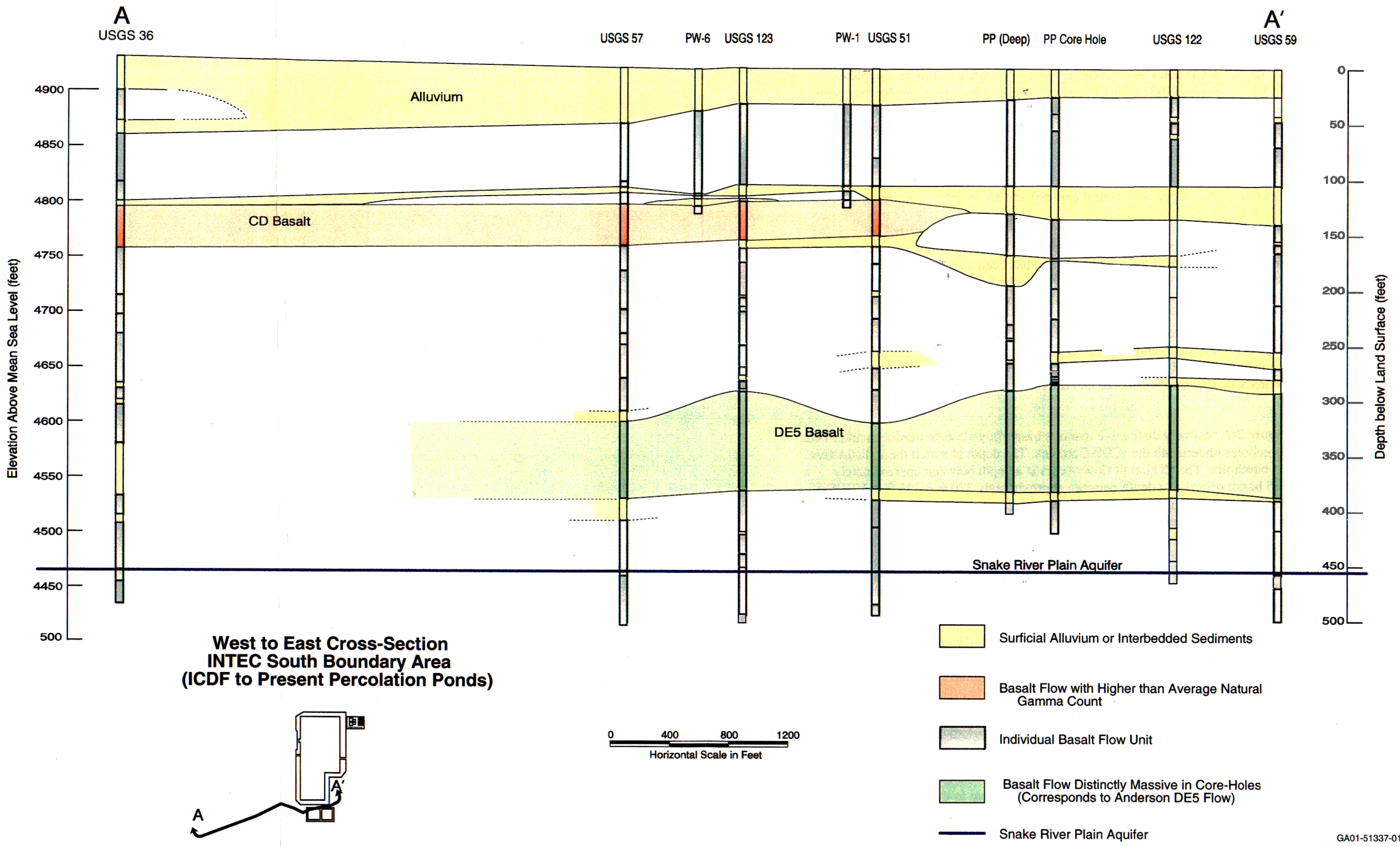

Figure 2-2. An east-west geologic cross section through the ICDF.

2.2.2.2 *Snake River Plain Aquifer.* The SRPA underlies the ICDF Complex and is located about 450 ft below land surface. Groundwater in the SRPA generally occurs under unconfined conditions but locally may be semiconfined or artesian (Nace et al. 1959). Regional groundwater flow is generally south-southwest at average estimated velocities of 5 ft/day. The average groundwater velocity at the INTEC is estimated at 10 ft/day due to local hydraulic conditions. This information is from pumping tests (INEL 1995a and DOE-ID 1997a).

A small amount of recharge to the SPRA occurs directly from precipitation. Recharge to the SRPA within INEEL boundaries is primarily by underflow from the northeastern part of the plain and the Big Lost River. Recharge from the Big Lost River to the SRPA can be substantial downstream of Arco. Measured infiltration losses at various discharges ranges from 1 to 28 $ft^3/s/mi$ (Bennett 1990).

2.2.2.3 *Perched Water.* The following sections provide a description of perched water found at INTEC.

2.2.2.3.1 *Perched Water Formation and Dissipation*—On the INEEL, perched water can only form in response to a source of surface water. As this water infiltrates downward through the alluvium and the underlying transmissive basalts, the water is impeded by lenses of low-permeability sediments and potentially by low-permeability basalt flows, creating local areas of higher water saturation or moisture content. In some instances, enough water is present to form local perched water bodies. Perched water can form naturally at the base of the alluvium in response to rapid snowmelt or heavy precipitation events. Deeper zones of perched water in the interbeds can form near the Big Lost River when it is flowing. The water dissipates when the transient source of water stops. Year-round precipitation is insufficient to form continuous perched water—in part due to the low precipitation rates and the higher evapotranspiration rates. In order to form year-round perched water on the INEEL, a continuous source of surface water is necessary.

Percolation ponds have been the primary sources of recharge to perched water adjacent to the ICDF Complex. Perched water under the ICDF Complex forms discontinuously and intermittently when downward infiltration is impeded. Geotechnical borings to the top of bedrock beneath the ICDF Complex did not identify any saturated water bodies. There was an increase in moisture content related to the fine-grained sediments overlying the basalt. Moisture content varied indirectly with the amount of sand present and ranged in value from 8 to 30%. The more sand, the lower the moisture content (DOE-ID 2000d). Under the ICDF Complex, perched water has been documented to occur at the primary series of interbeds above the upper marker basalt bed. This perched water forms in response to wastewater discharge to the western-most of two percolation ponds. As will be shown in the discussion that follows, the perched water is transient and dissipates when discharge is switched from the west to the east percolation pond.

The two percolation ponds were built south of INTEC to replace the injection well. The eastern pond (Pond #1) was brought on line in February 1984, when routine discharge to the injection well ceased. The western pond (Pond #2) was brought on line in October 1985. Although discharge volumes have varied over the years, average discharge to the ponds from 1989 to 1991 was approximately 540 million gal/year or 1.5 to 2.5 million gal/day (INEL 1995a). The USGS drilled shallow boreholes (SWP series, or SWPP series) in 1983 prior to the construction of the unlined INTEC percolation ponds. SWP-8 and SWP-13A (location shown on Figure 2-1) were used to monitor shallow perched water in surficial sediments. Both of these wells have gone dry intermittently, even though water has been continually discharged to one percolation pond or the other since they came on line. It is unclear what caused the water level fluctuations in these wells. Water levels over time for the SWP wells are plotted on Figure 2-3.

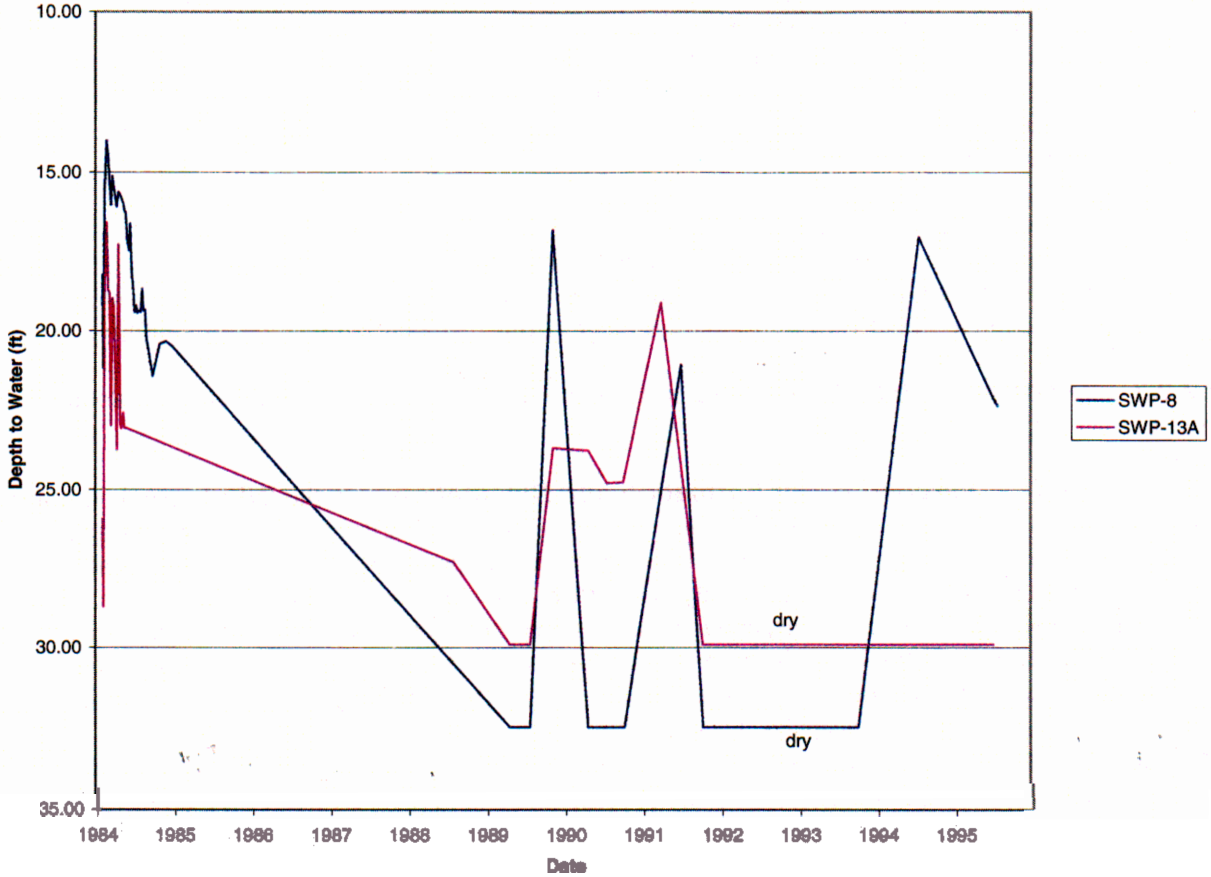

Figure 2-3. Water levels in SWP wells near the percolation ponds.

The USGS installed perched wells (PW) -1 through -6 in 1986 to monitor perched water due to wastewater seepage from the percolation ponds (Tucker and Orr 1998). The locations of the wells are shown on Figure 2-1. Well PW-6 is located on the northern edge of the northern-most ICDF landfill cell (#1). PW-1 is located just east of the eastern-most ICDF evaporation pond and just west of the western-most percolation pond. A cross section from PW-6 to east of the percolation ponds is shown on Figure 2-4. The PW wells are completed in the main interbeds just above or into the massive marker basalt. Open intervals are shown on Figure 2-4. A north-south cross section through the PW wells with perforated intervals is shown on Figure 2-5.

Except for PW-4, all of the PW wells are completed with 19 to 20 ft of perforated casing through one to two interbeds. Lithologic logs and completion diagrams for these wells are in Appendix B. PW-4, which is just east of the eastern-most percolation pond and farthest from the ICDF Complex, has a larger perforated interval, because thicker interbeds occur to the east. It is open through two interbeds. PW-5 is located between the two percolation ponds, PW-3 is located just north of the two percolation ponds, and PW-2 is located just south of the two percolation ponds.

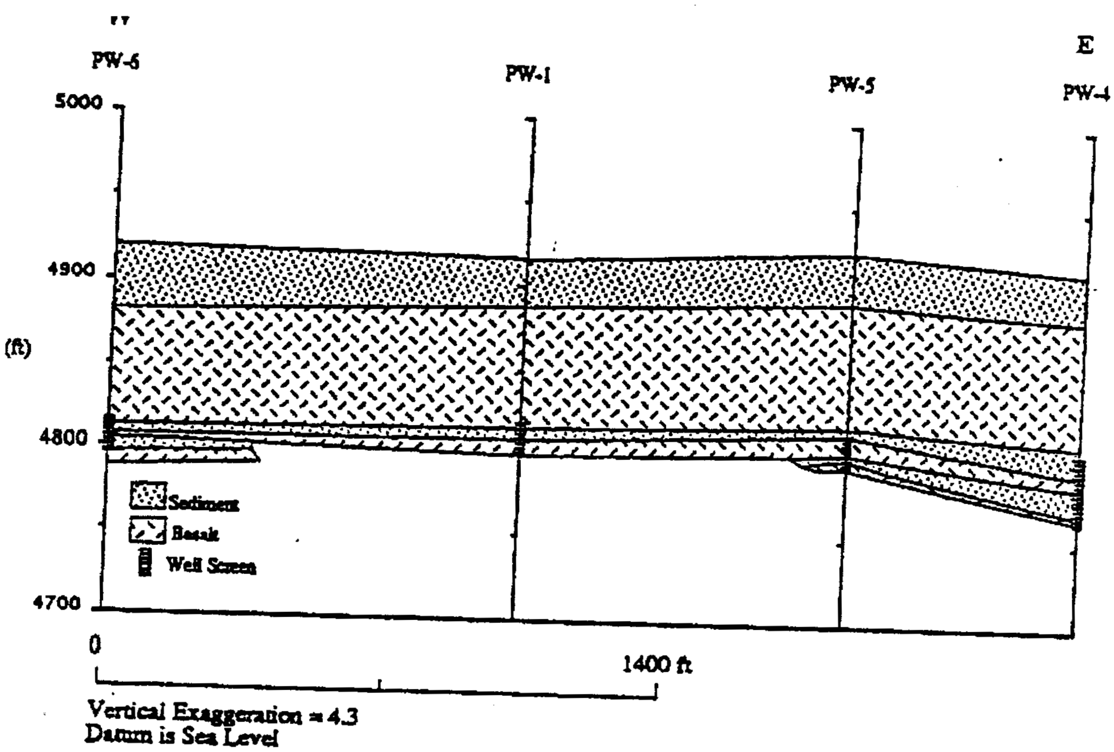

Figure 2-4. A cross section from PW-6 to east of the percolation ponds.

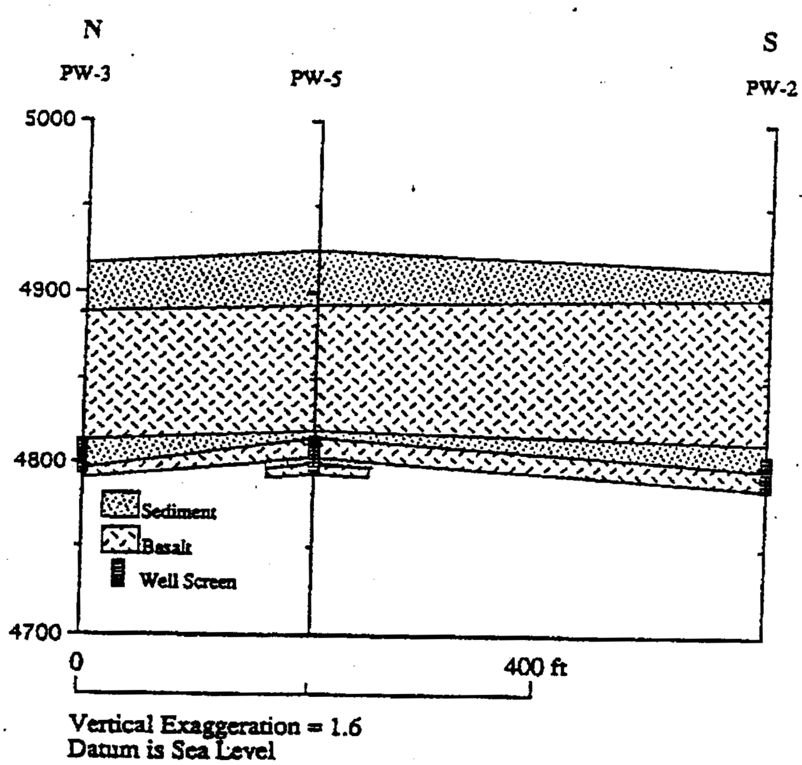

Figure 2-5. A north-south cross section through the PW wells.

The water levels in each PW series perched water well around the old percolation ponds are plotted at the top of Figure 2-6, with the scale on the left vertical axis. The wells to the west of the percolation ponds and closest to the ICDF Complex are PW-1 and PW-6. These wells behave similarly and have periodically gone dry. PW-6, which is the farthest from the percolation ponds, is shown as a thick red line and went dry from 1989 to 1990, from 1995 to 1997, and has been dry since mid-2000. PW-1, which is just west of the west percolation pond and is shown as a thick navy blue line on Figure 2-6, went dry in 1995 and again in 2000. PW-4, which is just east of the east percolation pond, is shown as a thin brown line on Figure 2-6. The water levels in this well behave opposite to the water levels in PW-1, which is just west of the west percolation pond. When water levels are low in PW-4, they are high in PW-1 and vice versa. For example, from 1986 to 1988, wastewater was discharged to the west (#2) percolation pond (Cecil et al. 1991), and water levels were high in PW-1 and PW-6 and low in PW-4. Figure 2-6 also demonstrates that when water levels are increasing in PW-4, they are decreasing in PW-1 and vice versa. These two wells respond to switches in discharges between the ponds. For example, in late fall 1995, water was switched from the east percolation pond (Pond #1) to the west percolation pond (Pond #2). At the same time, the water levels began to increase in PW-1 and decrease in PW-4 in response. Likewise, water was switched from the west pond to the east pond in February 2000, and PW-1 and PW-4 responded quickly.

In contrast, water levels in PW-2 and PW-5 remain relatively flat (shown as a thin pink and green line on Figure 2-6). PW-2 is just south of the two ponds and equidistant from both ponds, and PW-5 is in between the two ponds.

On the bottom portion of Figure 2-6, discharge in the Big Lost River measured daily at the USGS Lincoln Boulevard gauging station is plotted. The station is adjacent to INTEC. The right vertical axis is river discharge in cubic ft per second (cfs). There is no correlation between the flow in the Big Lost River and water in the perched water wells around the percolation ponds and the ICDF Complex. There was no flow in the Big Lost River near INTEC from mid-1987 to mid-1993. All of the PW perched water wells had water in them during this period with the exception of PW-6, which went dry for about a year in the middle of this period. PW-6 then had water in it during the time the Big Lost River was mostly dry. When the Big Lost River started to flow again in 1985, both PW-1 and PW-6 went dry. Figure 2-6 clearly shows that the upper perched water wells around the ICDF Complex and the percolation ponds are not influenced by flow in the Big Lost River but are influenced by discharge to the percolation ponds. PW-1 and PW-6, which are closest to the ICDF Complex, have gone dry periodically and are not a reliable source of water.

In contrast, the water levels in USGS-78, which is about a mile northwest of the ICDF Complex, respond within days to flow in the Big Lost River. USGS-78 is approximately 235 ft from the river and is 203 ft deep. It is an open hole from 66 to 203 ft. Within 4-1/2 days after flow starts in the Big Lost River, the water level in USGS-78 begins an abrupt rise. The water level may rise as much as 100 ft within a few months. The water level in the well is very sensitive to river stage, and as stream flow declines or ceases, the perched water level declines abruptly. Barraclough and Jensen (1976) found declines of 60 to 90 ft within 3 or 4 months (reported in INEL 1995a). Discharge in the Big Lost River and the response in the well are plotted on Figure 2-7.

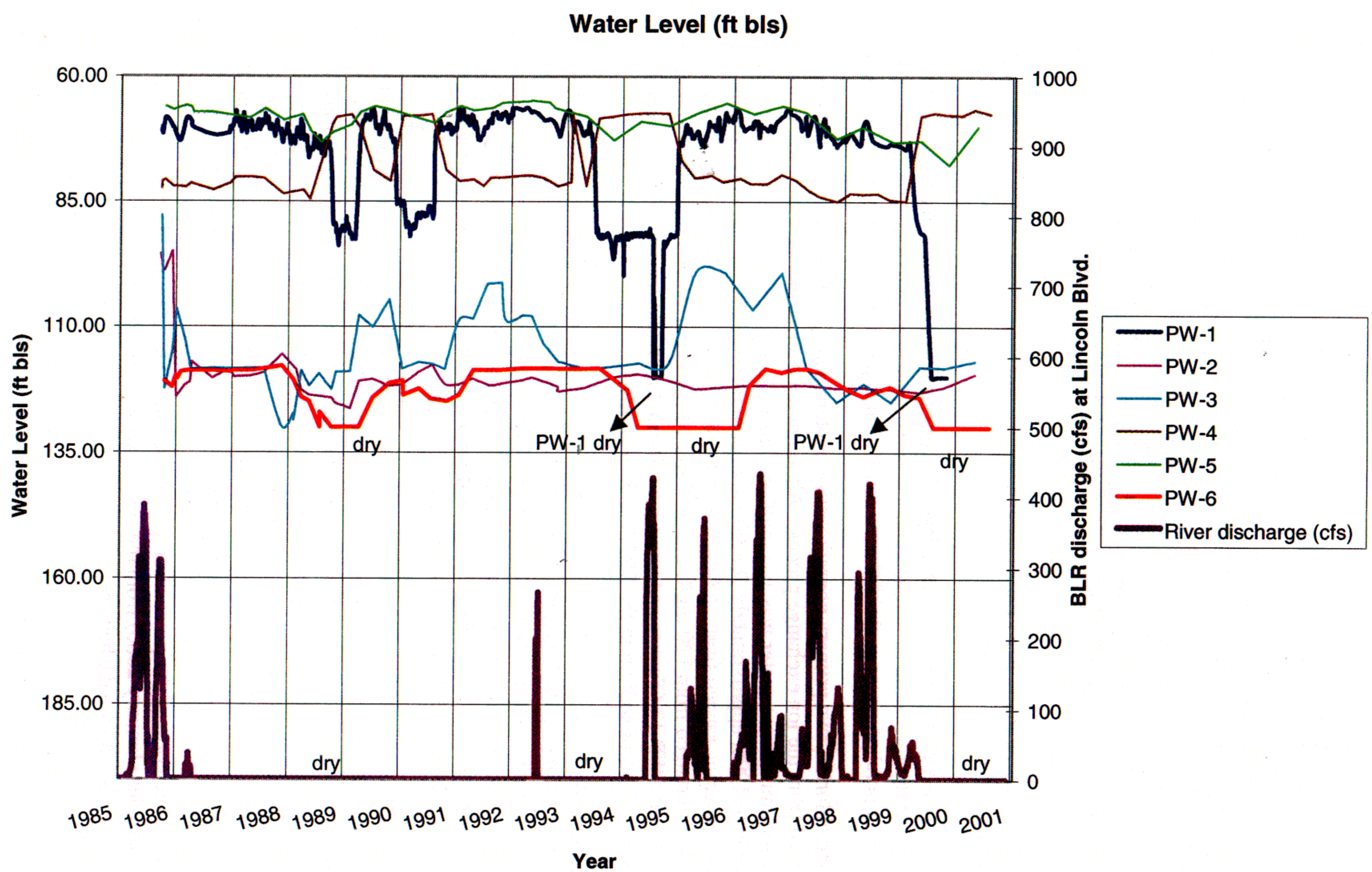

Figure 2-6. Water levels in PW series perched water wells and discharge in the Big Lost River at Lincoln Boulevard.

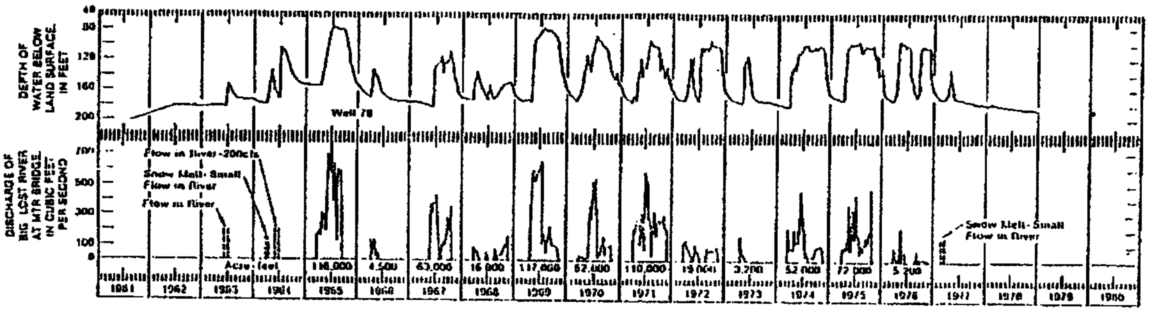

Figure 2-7. Plot of discharge in the Big Lost River and response in Snake River Plain Aquifer well USGS-78 (from Barraclough et al. 1981).

2.2.2.3.2 Perched Water Chemistry**—**The physical link between discharge to the percolation ponds and the formation of perched water was demonstrated above. In this section, the chemical signature of perched water at INTEC and the relationship to sources of water are discussed.

Sodium and chloride, two primary nonradioactive contaminants, were discharged to the percolation ponds and stemmed from the ion exchange process. Although concentrations vary over the years, average concentration of sodium in wastewater was 103 mg/L during 1971 to 1973 (Barraclough and Jensen 1976). During 1996 to 1998, approximately 708,000 lb of sodium were discharged to the ponds. The discharge weighted average ranged from 163 mg/L in 1996 to 124 mg/L in 1998 (Bartholomay and Tucker 2000). Sodium ranged from 120 mg/L in PW-6 to 210 mg/L in PW-1. Similar concentrations were reported in SWP-8 and SWP-13 (Tucker and Orr 1998). Barraclough and Jensen (1976) reported background concentrations of sodium in the SRPA as 8 to 10 mg/L.

Discharge of chloride also varies over the years. About 3.6 million lb of chloride were discharged to the ponds between 1989 and 1991, and 3.5 million lb were discharged between 1996 and 1998. The discharge weighted average concentration was 267 mg/L. With the exception of two concentrations from well PW-6, chloride concentrations in perched water (SWP wells and PW wells) near the ponds reflect chloride concentrations in wastewater. Barraclough and Jensen (1976) reported that the background concentration of chloride in the SRPA is between 8 and 15 mg/L.

Schoeller diagrams are graphical methods used to demonstrate patterns in water chemistry. These diagrams display the composition of cations and anions in such a way that groupings and trends become readily apparent. Figure 2-8 is a Schoeller diagram that shows the concentrations of major ions for different INTEC waters. The Schoeller diagram emphasizes the absolute concentrations of ions in water. All of the water in the shallow perched water around the ICDF Complex and the percolation ponds is high in sodium and chloride. PW-1 (orange triangles), PW-2 (pink X), PW-4 (brown diamonds), and PW-5 (green asterisk) are all very similar waters and plot almost on top of each other. These data are from October 1991, when there was water in the perched water wells around the ICDF Complex. In contrast, water from farther to the north of the percolation ponds and the ICDF Complex is lower in sodium and chloride. Recent samples (January 2000) from the service wastewater (SWW) line that goes to the percolation ponds are shown by a dashed green line with open squares. The process has been improved over the past decade, and the SWW water quality is lower in sodium and chloride than when the perched water samples were taken in 1991. Although the concentrations are lower in the 2000 SWW samples, the wastewater is of similar composition to the 1991 perched water samples. For comparison, samples from Well 33-4, which is near the tank farm (plotted with yellow squares), and well 55-06, which is in the eastern portion of INTEC (plotted with yellow circles), are also plotted.

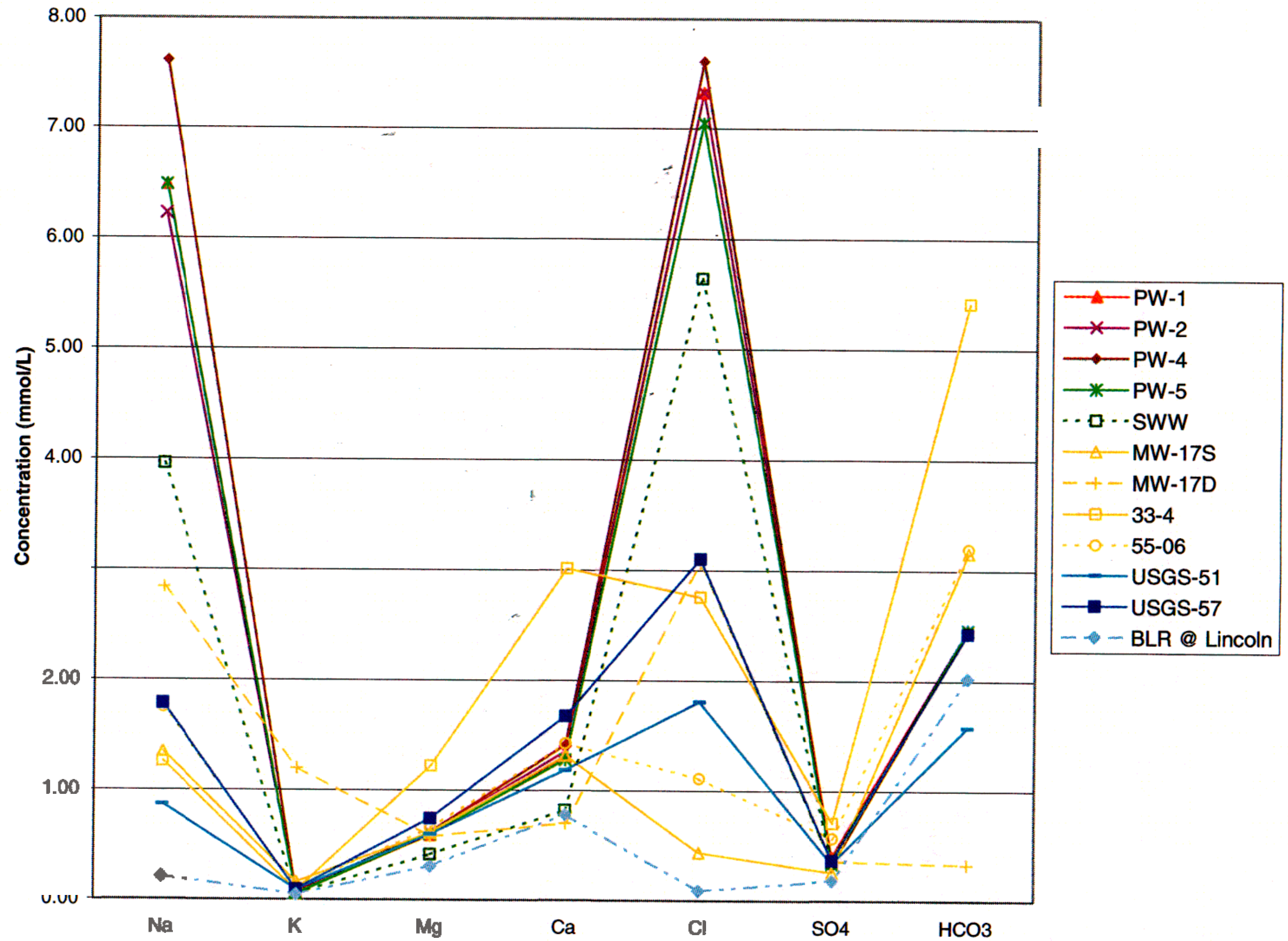

Figure 2-8. Schoeller diagram of water quality at INTEC for perched water, service waste water, the SRPA, and the Big Lost River.

Monitoring well MW-17 is north of the percolation ponds near the Building 603 fuel storage basins and was originally completed in three perched water zones. MW-17S monitors shallow perched water, is screened from 181.7 to 191.7 ft, and currently has water in it. MW-17P, which is currently dry, is screened from 263.8 to 273.8 ft. MW-17D monitored deep perched water and is screened from 360 to 381 ft. It is also currently dry. Data from a January 1995 sampling at MW-17S are plotted on Figure 2-8 as yellow triangles and at MW-17D as yellow plus signs. It is interesting to note that MW-17S was very low in all ions, whereas MW-17D had slightly elevated sodium and chloride but not as high as in the PW wells. This may indicate that water in MW-17D mixed with water from the service wastewater.

For comparison, water from SRPA monitoring wells, USGS-51 and USGS-57, located just east and south, respectively, of the ICDF Complex near PW-1, are plotted as solid blue lines. The chemistry in the SRPA near the ICDF Complex is very different from that in perched water wells in the same area. Similarly, water from the Big Lost River at the Lincoln Boulevard bridge, plotted as a dashed light blue line, is also distinctly different from the perched water.[a] In addition, there is a distinct difference in water chemistry between the perched water near the ICDF Complex, which stems from the percolation ponds, and the northern perched water from well 55-06 and from around the tank farm (well 33-4).

The Piper diagram is another method used to show differences or similarities between water samples. It is based on the ionic composition (millequivalents per liter [meq/L]) of a water sample and emphasizes the ratios between ions. Samples from the perched water around the ICDF Complex and the percolation ponds are shown as circles on the Piper diagram in Figure 2-9 and are high in chloride.

In this type of diagram, the similarity between perched water at the percolation ponds, the service wastewater, and MW-17D is more evident than it was on the Schoeller diagram. The differences between these two diagrams indicate that water from the percolation ponds has mixed with another source at MW-17D, which has diluted the concentrations of major ions but left their ratios the same.

USGS-51, the Big Lost River, and the INTEC water supply samples are very similar. In comparison, USGS-57 has higher chloride. The northern perched water is higher in chloride than the Big Lost River and USGS-51 but lower in chloride than the perched water from the percolation ponds.[a, b]

A trilinear anion diagram of perched water, Big Lost River water, and groundwater is shown in Figure 2-10. The upgradient aquifer (water supply [WS]) and Big Lost River are very similar with essentially no nitrate. The perched water around the percolation ponds is also low in nitrate but elevated in chloride. The northern perched zone has intermediate chloride but much more nitrate than other water sources. This nitrate could be from the sewage treatment plant or nitric acid from spills in the tank farm.

The USGS monitored the PW wells around the percolation ponds for Sr-90, H-3, and Cs-137 among other constituents of wastewater discharged to the percolation ponds. USGS data indicate H-3 and Sr-90 contamination in the perched water at similar concentrations to wastewater that was discharged to the ponds (Tucker and Orr 1998). Chloride, manganese, and iron exceeded the federal secondary drinking water standards. Sr-90, H-3, and nitrate have exceeded the primary drinking water standard in the past (INEL 1995a).

---

a. Personal communication with Leroy Knobel of the USGS, Idaho Falls, ID, November 2001.

b. Personal communication with Larry Hull of Bechtel BWXT Idaho, LLC, Idaho Falls, ID, November 2001

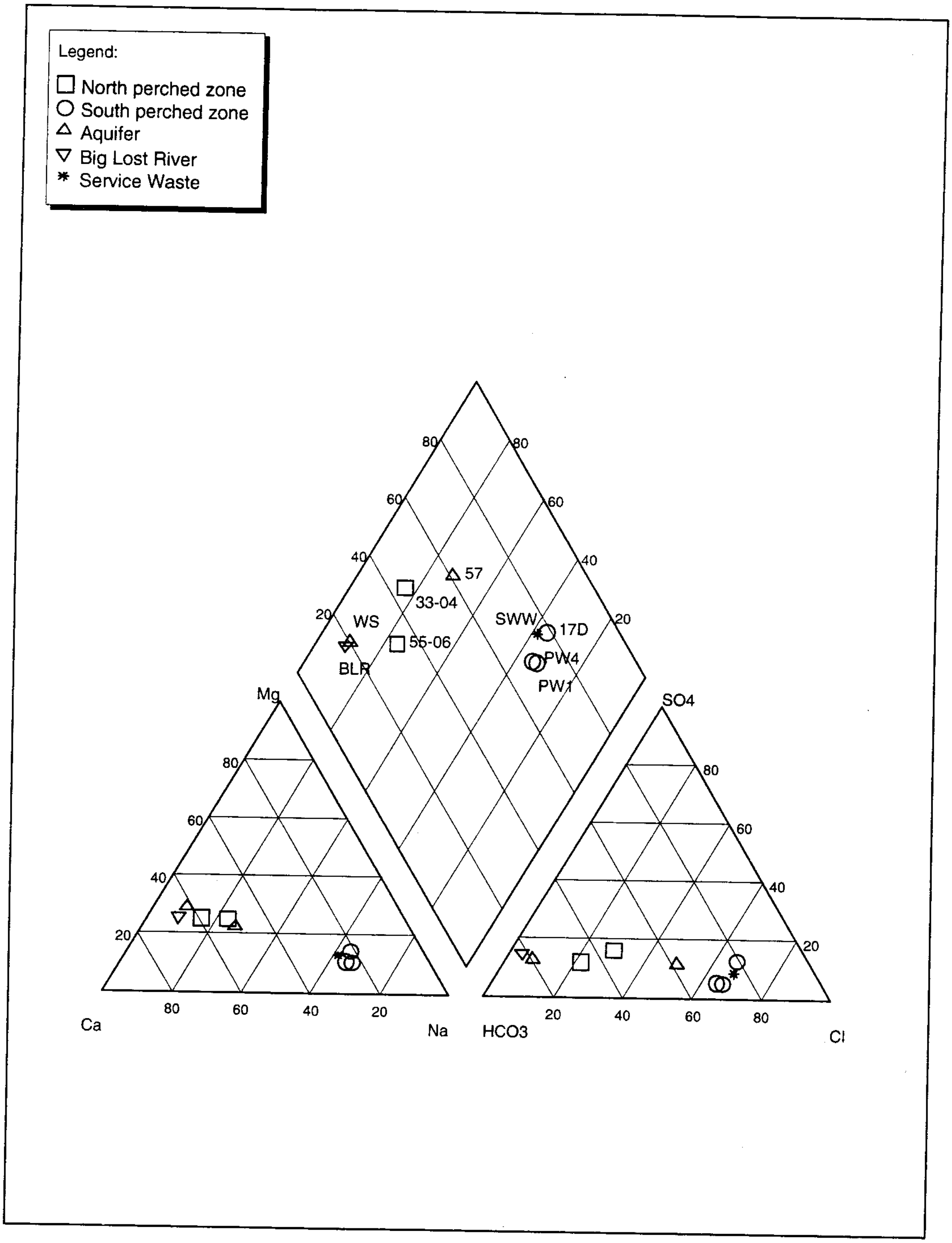

Figure 2-9. Piper diagram of water chemistry from perched water, the SRPA, and the Big Lost River.

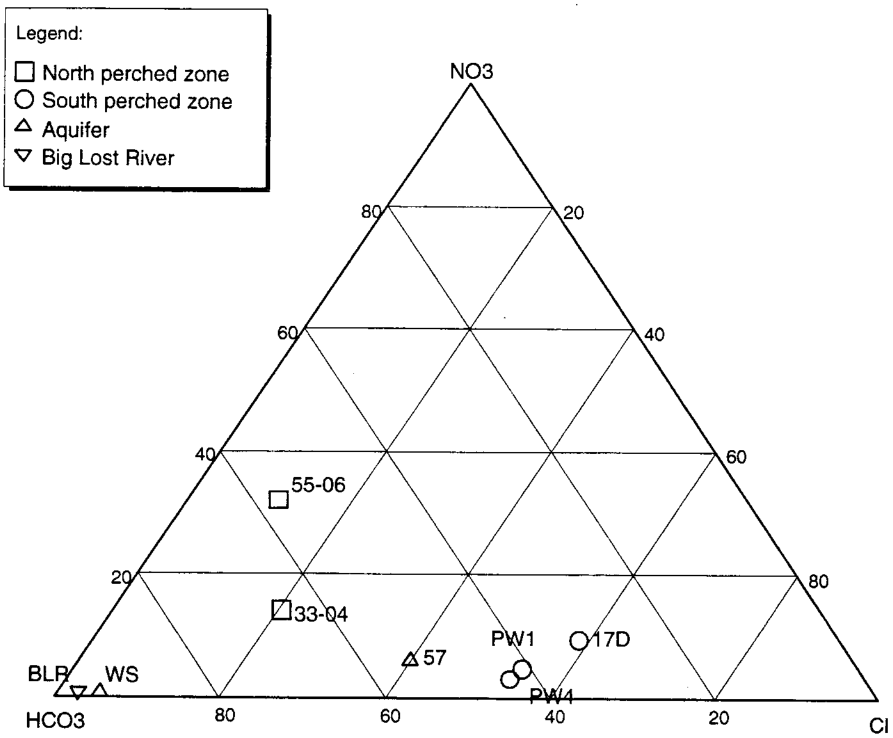

Figure 2-10. Trilinear diagram of anion composition of perched water, Big Lost River water, and SRPA water.

The percolation ponds adjacent to the ICDF Complex are scheduled to be taken out of service in December 2003. Water levels in the perched water around the ICDF Complex are expected to decrease over time, because the percolation ponds are the primary source of water. In other perched water wells at the INEEL (WAG 2, for example), contaminant concentrations have been known to spike as wells begin to go dry. Dramatic increases in concentrations are expected for the new perched water wells at the ICDF Complex as water levels decline. It is critical that this information be factored into any analysis of significant increases in order to avoid a false conclusion regarding a release from the ICDF landfill.

2.2.3 Identification of Uppermost Aquifer

As stated in 40 CFR 264.97(a), "The groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield ground-water samples from the uppermost aquifer." According to the TEGD (EPA 1986), the EPA has defined the uppermost aquifer as "the geologic formation...that is the aquifer nearest to the ground surface and is capable of yielding a significant amount of groundwater to wells or springs." The preceding sections of this groundwater monitoring plan have demonstrated that the two perched water wells on the edge of the ICDF Complex (PW-1 and PW-6) have periodically gone dry. The TEGD also states that, "The owner/operator should have ensured and demonstrated that the upgradient and downgradient well screens intercepted the same uppermost aquifer" (Section 2.1.2, page 52).

The percolation ponds received hazardous waste after July 26, 1986, and, as a regulated unit, the soils underwent RCRA closure. The perched water near the ICDF Complex has been shown in the preceding sections to be affected by leakage from the percolation ponds.

The above discussions have demonstrated that the formation of perched water at the ICDF Complex is linked both physically and chemically to leakage from wastewater discharge to the percolation ponds. It is also evident that the perched water is transient and the wells closest to the ICDF Complex can dry up in response to shutting off discharges to the western percolation pond. The percolation ponds are scheduled to be shut down permanently in December 2003, and it is expected that the perched water in wells near the ICDF Complex will dissipate. PW-6, which is the farthest away from the percolation ponds and is on the edge of the ICDF landfill, is already dry. The perched water will be monitored (where found) to provide early detection of leakage from the ICDF Complex. Once a perched water well goes dry, it will not be deepened or replaced.

Because of the pre-existing contamination in the perched water from the percolation ponds and contamination from the upgradient injection well in the aquifer, the ability to distinguish between contamination from other sources and leakage from the ICDF Complex will be critical. The evaluation of perched water sample results will be further complicated, because increases in concentration have been observed at the INEEL as perched water dries up. Therefore, standard statistical techniques may not be appropriate for the perched water, because increases in concentration may be a result of water levels dropping. A plan for evaluating the detection monitoring data will be presented once baseline data have been collected and analyzed. Other data, such as leachate concentration from the primary and tertiary systems, as well as concentrations in other Group 4 and 5 wells, will be used as lines of evidence in determining whether the ICDF Complex has leaked.

2.2.4 Identification of Groundwater Flow Paths

The hydraulic gradient in the SRPA around INTEC is very flat. Flow is generally south-southwest. The best indicator for contaminant flow direction is existing plumes, particularly because there appears to be large lateral dispersion. The I-129, H-3, Sr-90, Tc-99, gross beta, and chloride plumes are shown in Figures 2-11 through 2-16. All of these plumes have generally moved in a southwest direction from

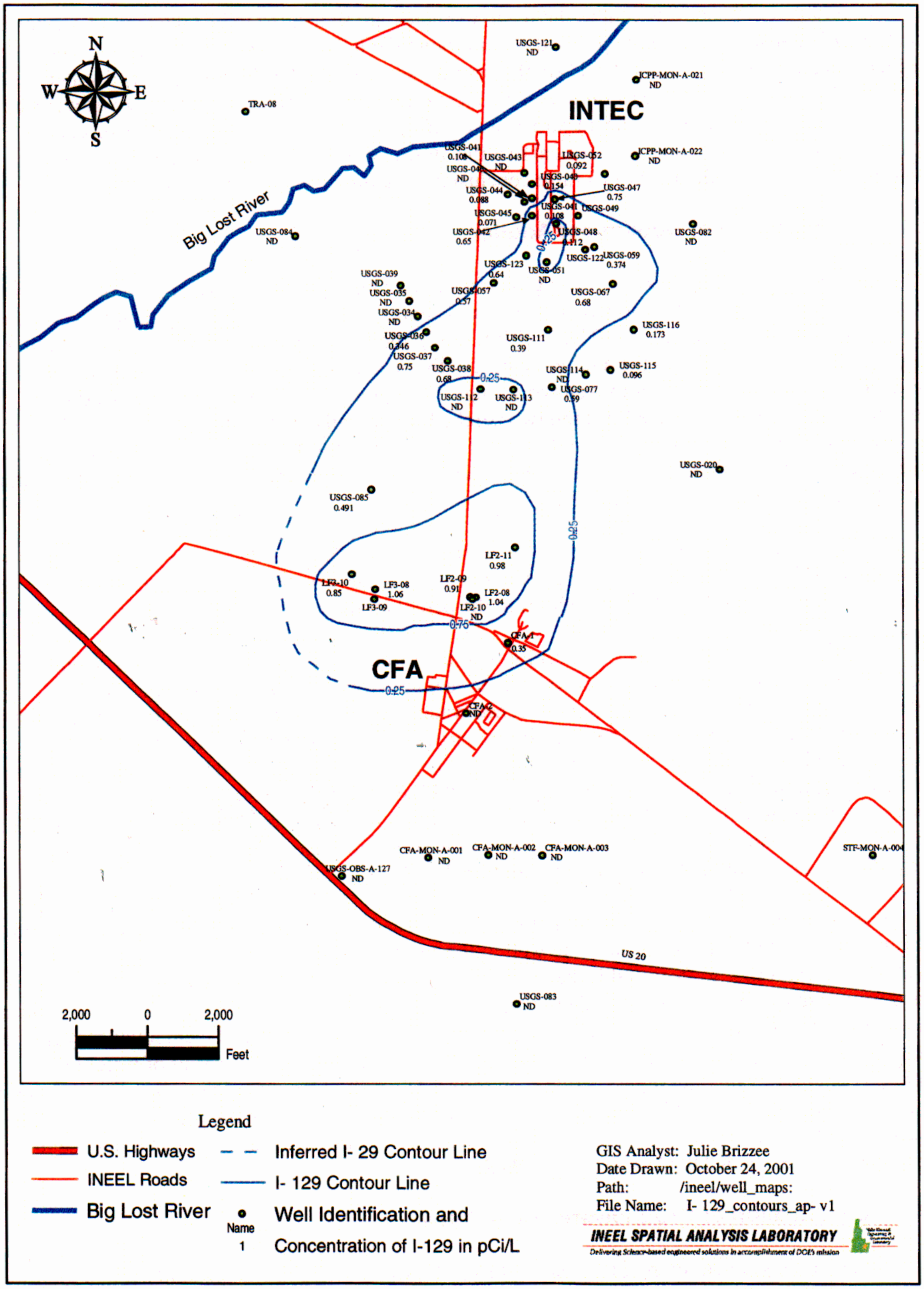

Figure 2-11. The I-129 plume in the SRPA.

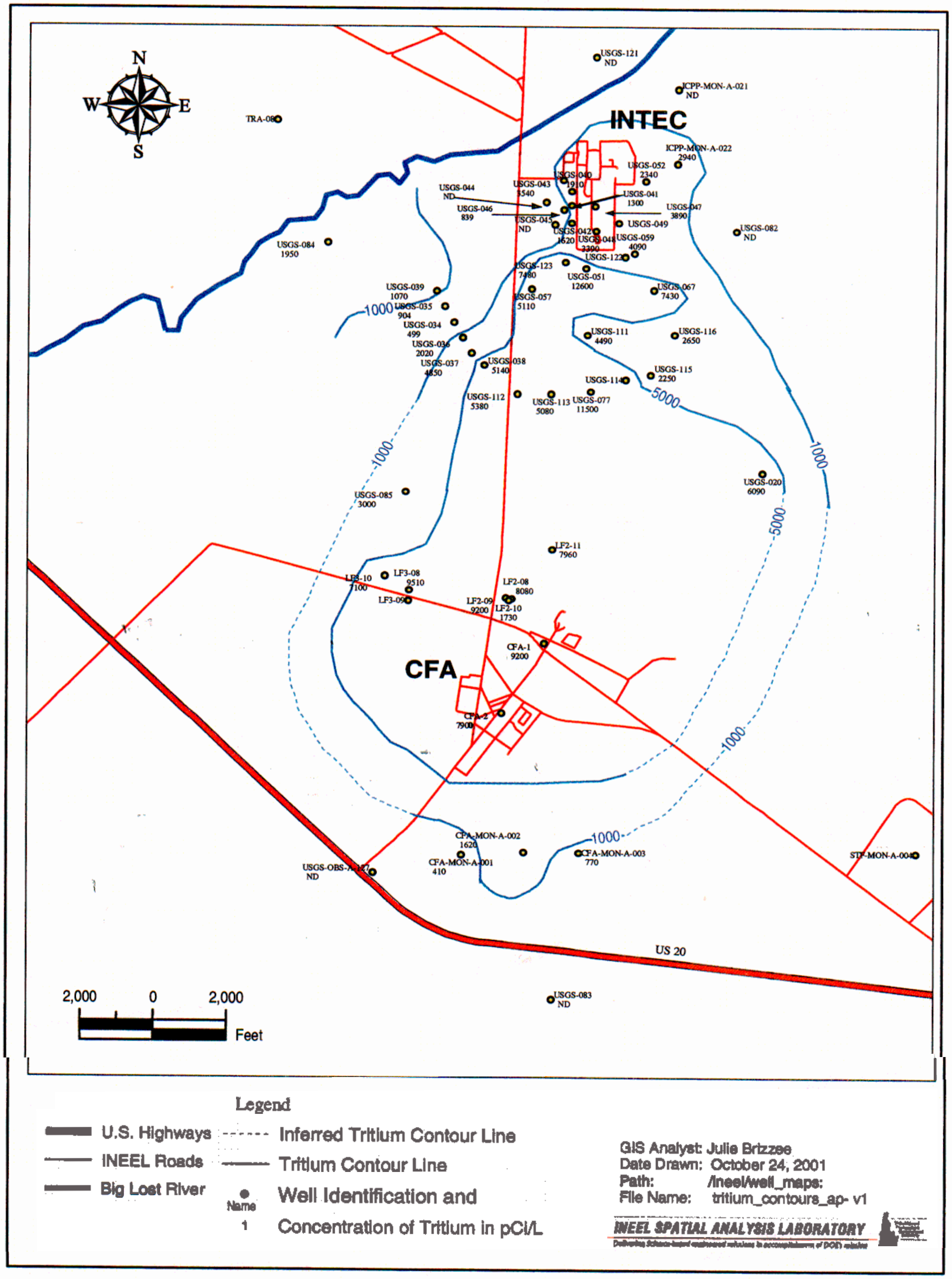

Figure 2-12. The tritium plume in the SRPA.

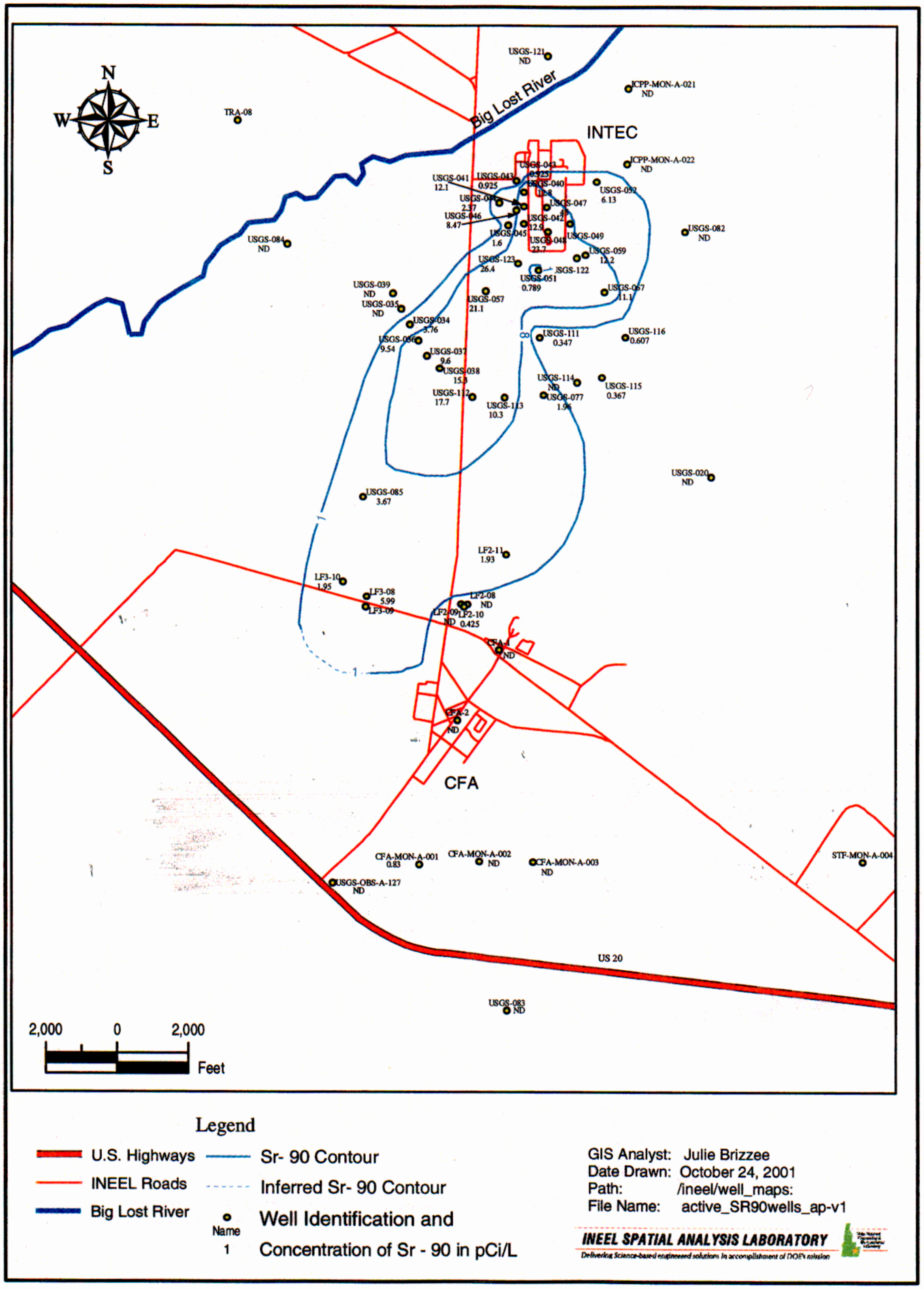

Figure 2-13. The Sr-90 plume in the SRPA.

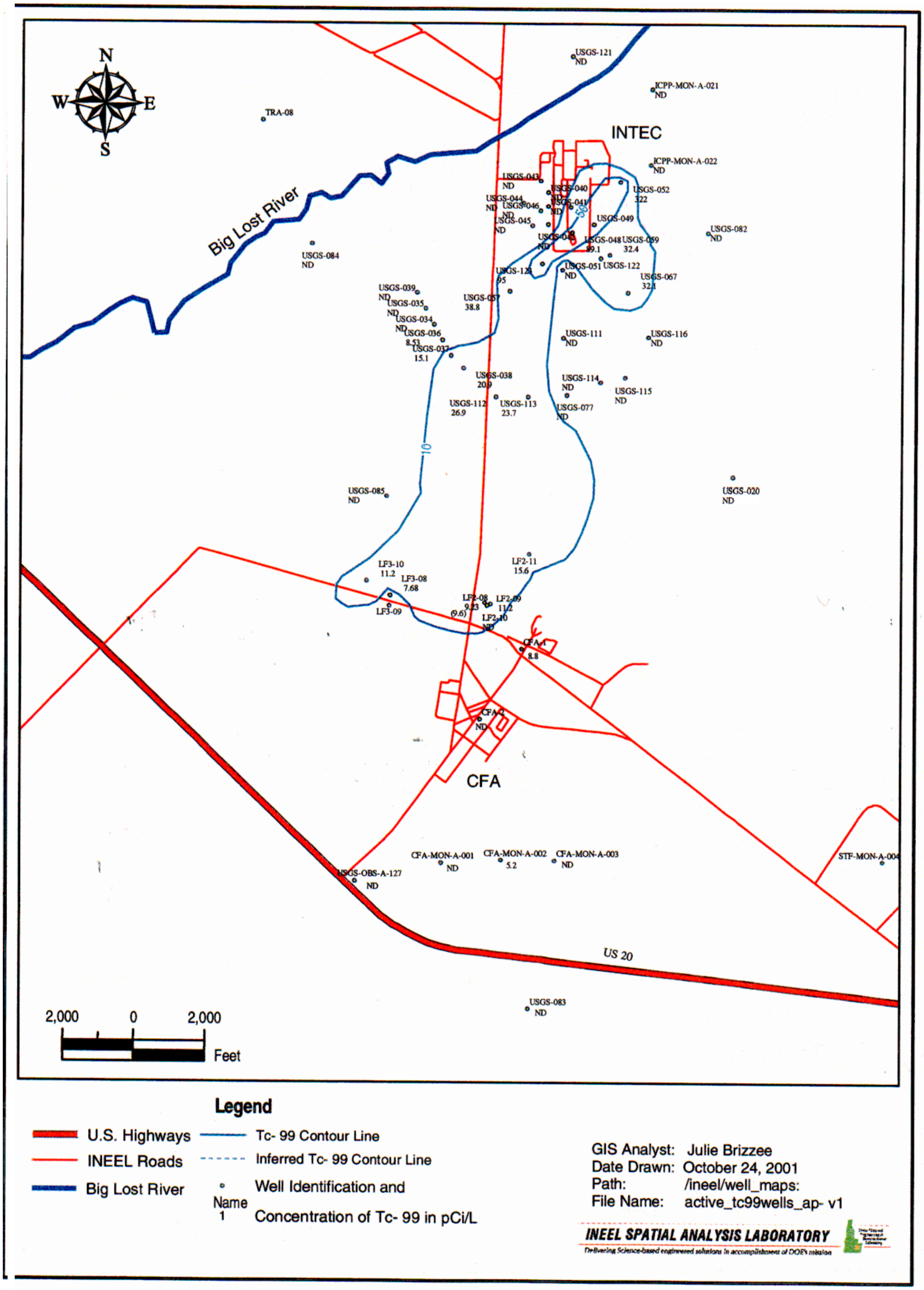

Figure 2-14. The Tc-99 plume in the SRPA.

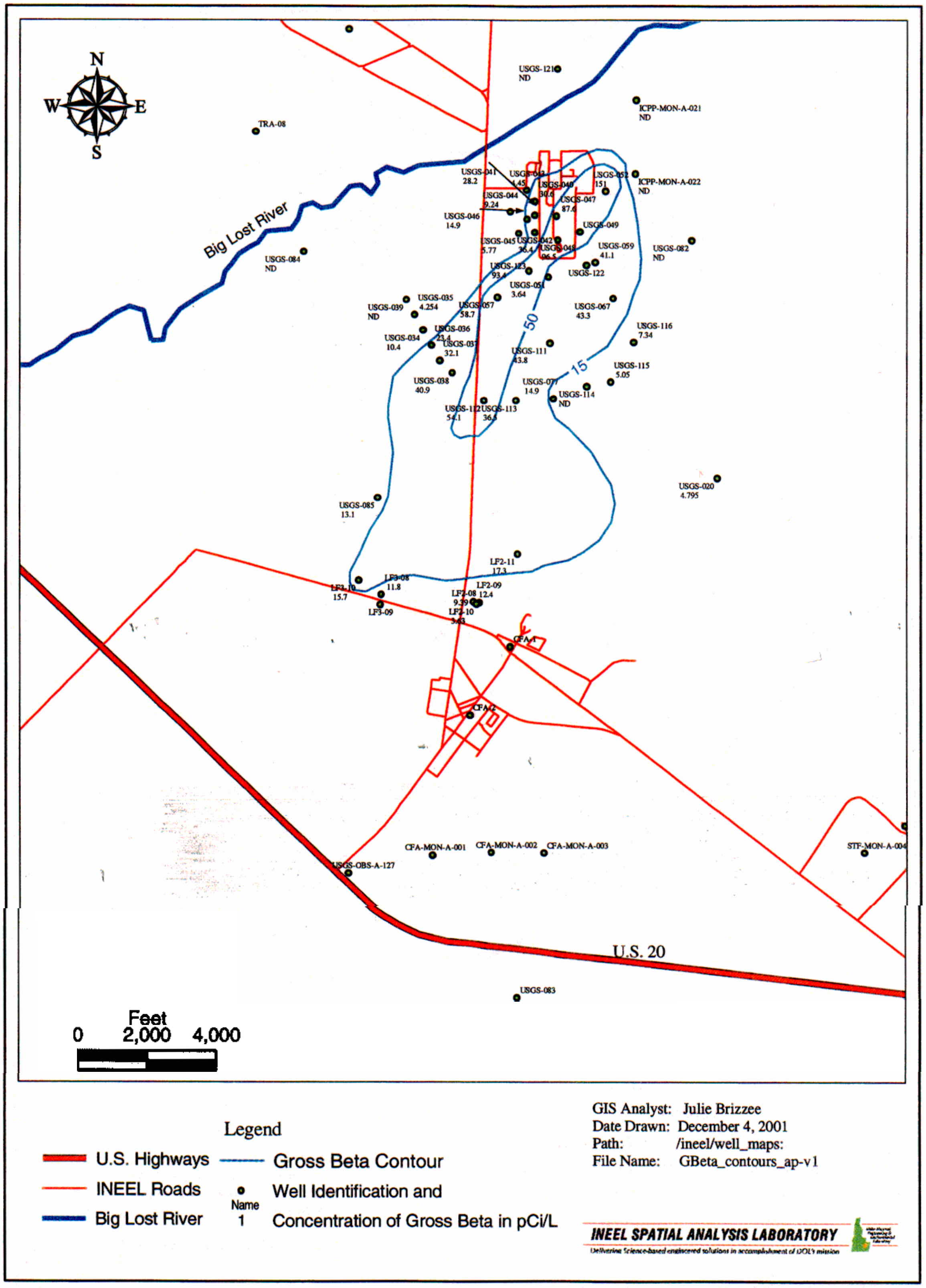

Figure 2-15. The gross beta plume in the SRPA.

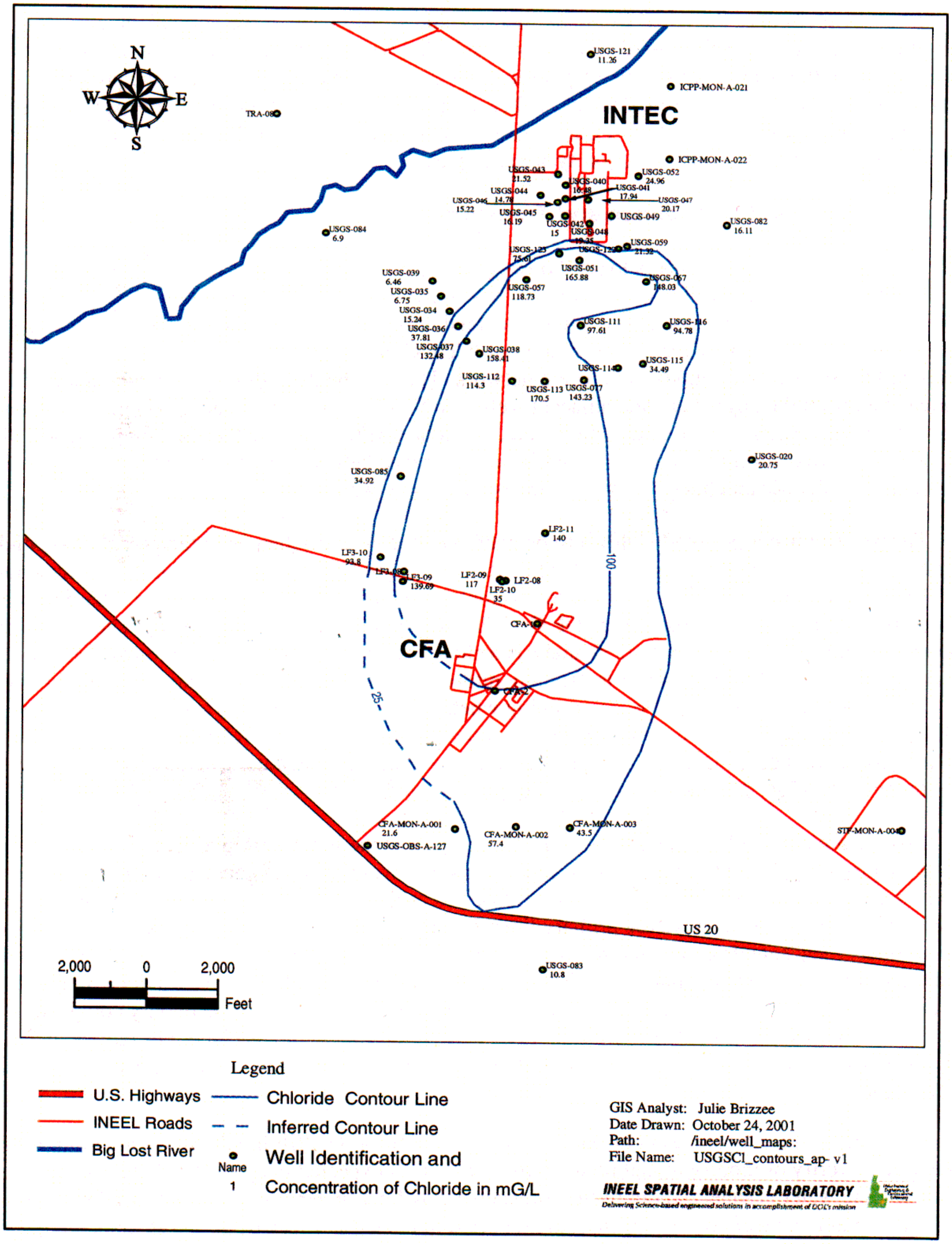

Figure 2-16. The chloride plume in the SRPA.

INTEC. The five downgradient detection-monitoring wells will be located in the SRPA near the southern and southwestern edges of the ICDF Complex. Because the groundwater at the upgradient and downgradient monitoring wells will already be contaminated with constituents similar to those that will be disposed of in the ICDF landfill and evaporation ponds, it will be critical to determine pre-existing contamination levels, i.e., background water quality, in the SRPA. In addition, another aspect of this monitoring strategy will be to analyze leachate samples from the ICDF landfill and compare the chemistry of the leachate to leak detection system samples.

2.2.5 Contaminant Distribution and Transport

Because the ICDF Complex is located downgradient from the former INTEC injection well, the SRPA is already contaminated from that well. As was shown in Figures 2-11 through 2-16, plumes of I-129, H-3, Sr-90, Tc-99, gross beta, and chloride extend beneath the ICDF Complex. It is critical that the baseline water quality in the SRPA in the vicinity of ICDF Complex be established and documented as background for the ICDF Complex monitoring network. This will be done through a combination of historical data from the upgradient and adjacent wells and baseline sampling conducted under this plan. Changes to water quality in the downgradient detection monitoring wells can then be compared with the upgradient wells to determine if there is a significant difference between the downgradient and upgradient water quality or significant changes in water quality in any one well.

The perched water is already known to be contaminated from discharges to the percolation ponds. The percolation ponds are scheduled to be taken out of service in December 2003. Spikes in concentration have been observed at the INEEL (WAG 2, for example) as perched water levels decline. Sharp increases in concentrations may occur in the new ICDF Complex perched water monitoring wells. These data may not lend themselves to standard statistical analysis techniques for groundwater. Therefore, other data, such as water levels and analytical results from monitoring of the primary and tertiary systems, will be used to fingerprint leachate and aid in determining whether increases in concentrations are caused by ICDF Complex leakage. These data will be used as lines of evidence when evaluating detection monitoring data from the ICDF Complex perched water wells. A groundwater evaluation plan will be submitted once baseline data have been collected and analyzed.

In determining which contaminants to monitor as part of the ICDF Complex groundwater monitoring program, it is helpful to examine predictions of travel times and concentrations of various contaminants. It is expected that contaminants will be detected initially at the primary leachate collection and removal system located above the primary liner. Landfill leachate would next be expected to be found at the secondary leachate detection and removal system located below the primary composite liner and above the secondary composite liner. If both liner systems fail, then landfill leachate will be removed from the tertiary leachate detection system located below both the primary and secondary composite liners. Nonretarded species would be expected to be discovered first in the leachate. For radioactive contaminants, half-life is also a factor in determining whether a contaminant will be detected and at what concentrations.

Leachate monitoring serves as an early warning if the ICDF landfill liner systems are failing and can be used to verify or modify model predictions. Leachate is expected in all the leachate detection systems as pore water is squeezed out of the compacted clay liner under compression from the ICDF landfill. If contaminants of concern (COCs) are detected in the tertiary leak detection system, the monitoring strategy can be altered as necessary.

Numerous fate and transport models have been used to predict future contaminant concentrations in the leachate and unsaturated zone pore water as well as transport times through the different layers to the SRPA. Modeling results are presented in the 30, 60, and 90% ICDF Complex design documents.

The leachate contaminant reduction time study (EDF-ER-274) predicts that over the 15-year operations period for the ICDF landfill, the "leachate will be a brackish to saline water dominated by sodium and sulfate and buffered by carbonates to a pH of around 8.2." Fate and transport modeling was conducted to predict potential concentrations in the SRPA over time from the ICDF landfill (EDF-ER-275). The concentrations were predicted for a hypothetical SRPA monitoring well located 20 m downgradient from the ICDF Complex. Various infiltration rates were assumed in order to determine design requirements of the ICDF landfill. The modeling predicts that the ICDF Complex will be protective of the SRPA if it operates as designed, and detectable concentrations of radioactive contaminants from the complex are not expected in the tertiary leachate detection system for over 100 years. Predicted concentrations over time at the base of the compacted clay liner for several key contaminants are shown in Figure 2-17. For I-129 (iodine), the tertiary system leachate concentrations are predicted to be below standard detection limits for the first 115 years. Standard detection limit, as used here, means a readily attainable detection limit that is around 10 times lower than the MCL or MCL equivalent. The MCL equivalent for I-129 is 1 pCi/L. For Np-237 (neptunium) and H-3 (tritium), the concentrations in the tertiary system leachate are not predicted to ever go above standard detection limits. The MCL equivalent for Np-237 is 15 pCi/L, and the MCL for H-3 is 20,000 pCi/L. It is predicted that concentrations of Tc-99 in the tertiary system leachate will only be detectable after 378 years, and Np-237 with Pu-241 and Am-241 will only be detectable after 2,460 years.

In order to provide a simple estimate of upper bound contaminant arrival times, analytical calculations were performed to predict the arrival times for an advective front from the ICDF landfill for the most mobile contaminants assuming various infiltration rates. For the operations and clay layers, which will each be 3 ft thick, the assumption of no cover over the waste and an infiltration rate of 0.0001 m/yr provides an upper bound on travel times. To be even more conservative, I-129 is assumed to have a distribution coefficient (K_d) of 0. Under this upper bound scenario, travel times through the operations and clay layers for the advective front would be 77 years for a nonretarded, nondecayed species such as I-129. For Tc-99, the travel time through the operations and clay layers would be 258 years. For Np-237, the travel time would be 9,469 years. Calculating travel times individually through each layer from the operations layer down to the first interbed and summing, yields over 250 years for I-129, over 600 years for Tc-99, and over 16,500 years for Np-237. Summing upper bound travel times down to the SRPA yields 1,104 years for I-129, 2,076 years for Tc-99, and 42,173 years for Np-237. Actual travel times are expected to be orders of magnitude higher due to the presence of a cover, liners, and leachate removal, which drastically reduce the infiltration rates.

These modeling results and calculations show that if the ICDF landfill performs as it is designed, monitoring leachate and water quality in SRPA and perched water wells should demonstrate that the ICDF Complex is protective and is meeting the RAOs. The leachate monitoring systems are designed to indicate failure of the landfill at the earliest possible time so that appropriate steps can be taken in order to protect the SRPA.

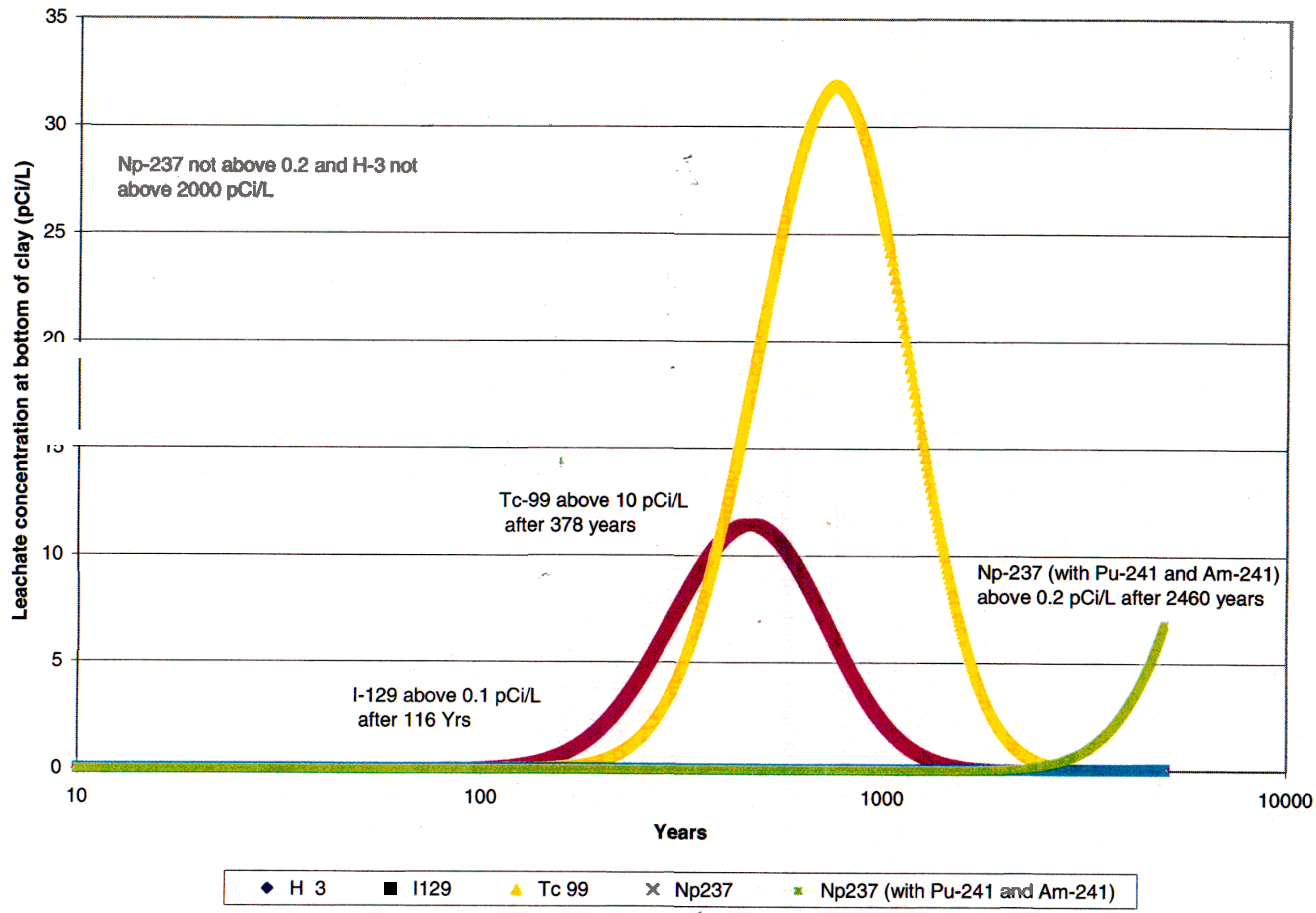

Figure 2-17. Predicted concentrations over time at the base of the compacted clay liner for several key contaminants.

2.3 Other CERCLA Site Actions

Monitoring and remediation of the subsurface is currently being conducted for WAG 3 beneath INTEC and the ICDF Complex. These monitoring programs are designed based on the OU 3-13 ROD requirements and cover the perched water system (OU 3-13 Group 4) and the SRPA (OU 3-13 Group 5).

2.3.1 Group 4 Perched Water

Remedial actions and monitoring of the perched water system beneath the INTEC facility are described in the OU 3-13 Group 4 work plan (DOE-ID 2000b). The basic objective of the Group 4 remedy is to remove significant sources of recharge to the perched water system beneath INTEC to allow for drain-out of the perched water system and immobilization of contaminants already in the unsaturated zone. The Group 4 remedial action initially requires relocation of the INTEC percolation ponds, which are located east of the ICDF Complex. Contingent recharge controls may also be implemented if the relocation of the percolation ponds is determined to be insufficient to meet the Group 4 RAOs. Five years after relocation of the percolation ponds, a decision will be made whether to apply the contingent recharge controls based upon the analysis of the 5 years of perched water monitoring and updated predictions of the perched water drain-out through 2095.

Group 4 Phases I and II, as described in the Group 4 work plan, will take the project to the point of the initial decision regarding contingent remedial action. This initial decision will be made 5 years after the percolation pond relocation, currently scheduled to occur in 2003. The Group 4 work plan describes new well installations, perched water tracer studies, unsaturated zone moisture monitoring, and sampling and analysis activities for all perched water monitoring wells at the INTEC facility associated with Phase I and the first 5 years of Phase II of the Group 4 remedy. After the initial 5 years of monitoring perched water drain-out following the percolation pond relocation, a monitoring report/decision summary will be prepared that documents monitoring data, rationale, and justification for the decision about whether there is a need for additional contingent recharge controls.

2.3.2 Group 5 Snake River Plain Aquifer

Monitoring of the SRPA beneath the ICDF Complex and INTEC is described in the OU 3-13 Group 5 work plan (DOE-ID 2000c). The basic objective of the long-term monitoring actions is to evaluate the contamination in the INTEC groundwater plume outside of the INTEC fence and to evaluate the flux of contaminants into the SRPA outside of the INTEC security fence line (Group 5) from contamination that is currently in the unsaturated zone and aquifer beneath the footprint of the INTEC facility. These data will be evaluated over time to determine if the flux of COCs into the SRPA will result in exceeding MCLs in 2095 and beyond. This will be accomplished through the long-term periodic sampling and analysis of aquifer monitoring wells in the vicinity of INTEC to track COC concentration trends through the institutional control period.

An initial baseline sampling of 47 aquifer monitoring wells was conducted in 2001. Following the baseline sampling, long-term monitoring of 20 wells at and downgradient of the INTEC facility will be implemented. The wells currently selected for long-term monitoring may be changed based on the results of the baseline sampling and the 5-year review. If additional wells are needed to monitor the SRPA, the long-term monitoring plan will be revised and a sufficient number of monitoring locations will be chosen to track the groundwater contamination. In addition, the number of wells to be sampled may be expanded every 5 years (baseline sampling) to allow for evaluation and modifications to the monitoring network.